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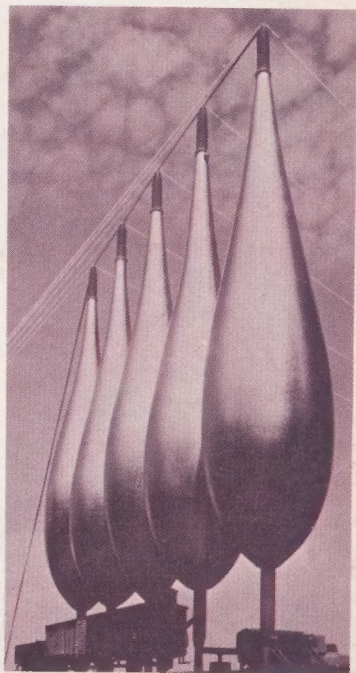
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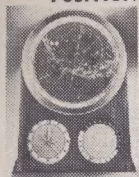
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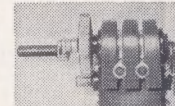
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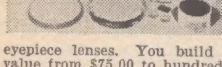
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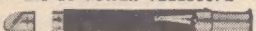
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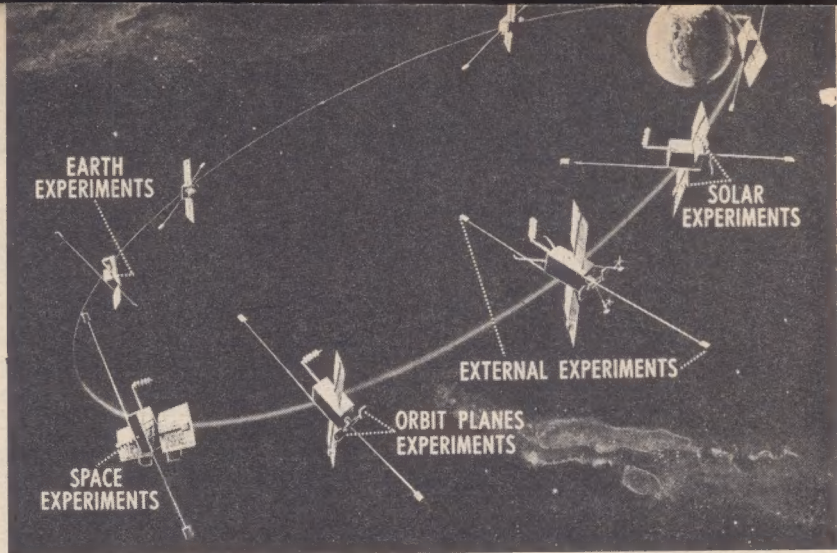
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Artist's conception of the path of OGO I. Later OGO's will have different orbits.

Observatory in space

OGO (Orbiting Geophysical Observatory) has its work cut out for it. This latest satellite (a series of six are scheduled to be launched) is designed to bring back as much information as possible about the area near the earth, and about earth-sun relationships.

Among the things OGO is expected to find out about are the potentially dangerous solar flares that some scientists feel will seriously threaten the lives of astronauts in Project Apollo (manned moon flights).

Other things OGO satellites will be looking into are cosmic rays, the origins of radio noise in space, the solar wind, the earth's magnetic field and magnetic storms, X-rays and ultraviolet rays and their effect on the atmosphere and ionosphere, micrometeorites and radiation particles.

The first of the OGO series was launched Sept. 4, and after some early trouble, began sending back data. Packed into the 59-foot satellite were 20 of the most advanced space instruments ever developed. Scientists from seven government agencies and nine universities cooperated in developing the experiments for OGO.

Although all six OGO launchings will use the same basic satellite structure, each will carry a different load of instruments to perform a different set of experiments. Thus OGO has often been called a "streetcar" or "omnibus" satellite.

The first OGO satellite weighed 1,073 pounds, of which only 172 pounds was taken up by the experimental equipment. Yet OGO's radio system can relay enough scientific information in one minute to fill three standard-sized novels.

SCIENCE DIGEST

Twenty-eighth year of publication

Three Lions Photo

Biologists are now learning how strongly early experiences influence a child's ability to learn. An educator and Nobel prize-winning biologist believes our schools are 'missing the boat' with many children. See page 28.



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SCIENCE DIGEST is published monthly by The Hearst Corporation, 959 Eighth Avenue, New York, N.Y., 10019. RICHARD E. BERLIN, *President*; GEORGE HEARST, *V-Pres.*; RICHARD E. DEEMS, *President of Magazines*; FRED LEWIS, *Executive V-Pres. of Magazines*; JOHN R. MILLER, *V-Pres. and Gen. Mgr. of Magazines*; G. HARRY CHAMBERLAINE, *V-Pres. of Research and Marketing*; WILLIAM S. CAMPBELL, *V-Pres. and Director of Circulation*; FRANK MASSI, *Treasurer*; R. F. McCauley, *Sec.*

Tips and Trends

ATOMIC FOOTBALL. A battle is shaping up to determine who's to get future atomic-research dollars. The contenders: physicists who favor high-energy accelerators, those who favor the low-energy variety. The AEC favors building a \$60 million accelerator of the latter kind at the Los Alamos (N.M.) Scientific Laboratory. Proposals by Oak Ridge (Tenn.) National Laboratory, Brookhaven (N.Y.) National Laboratory (with Yale) and USC have been turned down.

MIDWEST RESEARCH. States in the Midwest hope to get more research dollars for private enterprise purposes. They get only 8 percent of the military R&D funds spent. Commerce Secretary Hodges proposes Federal matching grants for university projects aimed at regional and local efforts to attract industry.

ATOMIC POWER PLANTS. There are going to be more and bigger ones than ever. Britain is building a huge 1,180 megawatt power station. We're building 500 mw stations, will soon go on to 1,000 mw ones, too. So will France and Russia. The point: Power is cheaper that way.

SHORTS: The Federal attitude toward pesticides is getting sterner; long-lived pesticides have been all but prohibited on 550 million acres of public lands....A continuous ion exchange process by Chem-Seps of Oak Ridge, Tenn., promises a revolution in applications from radioactive milk decontamination to aluminum finishing....A new rat poison, harmless to other animals, made by McNeil Laboratories, Fort Washington, Pa., may end a world menace.

LETTERS



Saving teeth

I purchased and read your wonderful magazine for the first time in August, and was amazed at the information it contained. You must be very proud of *Science Digest*.

In "The Progress of Medicine," I was amused by the item "New Life for Old Teeth." Dr. Ralph R. Mezrow deserves credit for the work he is doing, but I feel I must ask a small bit of credit for a dental surgeon in Dublin, Ireland, for doing the same job for me.

When I was 13 years old, I was knocked down by a truck and my two front teeth were knocked out. I was brought to Patrick Dunn hospital and this good doctor put the teeth back in. I am now 33 and the teeth are still there.

This man, Dr. Dugdale, died some years ago, so I couldn't even thank him, as I only realized later the great service he did for me.

MICHAEL HALE
Weston, Ontario
Canada

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Color by touch (cont.)

The discussion in your letters column of the article "The Woman Who Tells Color by Touch" (April '64) reminds me of an incident that happened when I was a small child.

One of our favorite games was a carom board with twenty-four "men" (much like checkers). Half were black and the other half white or really blond wood. All had a hard or smooth finish.

I was five years old when I discovered quite accidentally that I could close my eyes tightly and while holding either color checker in my hand, easily tell which color I had. My older brothers called Papa in to see this feat. He had me do it many times and I never failed; in fact, I remember that it seemed to get easier the longer I kept at it.

Papa kept asking me to explain in what way they felt different—warm and cold, rough and smooth—what? With all the simple and stubborn truthfulness of a five-year-old, I kept answering, "One feels black, and one feels white."

Papa, who was a most scientific and scholarly type of man, got quite angry and ordered me to stop. In fact, I am sure it was his attitude which so impressed the whole incident in my mind. He practically threatened to clobber me.

It is difficult for us to understand how the functions of two of the senses might overlap, yet I still remember how one checker felt black and one felt white. And this was just as clear to me as if I were looking at them.

No, I cannot do it now—that was over 50 years ago.

ELLEN DAHL
Panorama City, Calif.

Freedom of or freedom from?

David Peterson commits a common error by giving credit for the peaceful development of this country to religion (Letters, Sept. '64).

For 300 years, there has been more freedom of thought here than in almost any other country in the world. This means both freedom of religion and freedom from religion.

The U.S., in spite of high moral standards represented by our Constitution and laws, is not and never was intended to be identified with any religion.

People whose enthusiasm and lack of tolerance cause them to make public claims to the contrary do the rest of us a distinct disservice.

EDWARD N. HERR
Hickory, N.C.

Four irksome items

I generally find *Science Digest* an informative and interesting magazine. However, I cannot help but comment on four items which irked me about your Aug. '64 issue.

The author of "Dinner in 90 Seconds" refers to calcium carbonate as "slaked lime." Slaked lime is the result of adding water to calcium oxide and is basically calcium hydroxide. Calcium carbonate is better known as chalk.

The "outraged animal lovers" mentioned in "Science in the News" have little reason to fret. An isolated brain has no capacity to feel pain inflicted on itself. It lacks the nerve cells to do so.

I also take issue with the "Quote of the Month and Year" in "Science in the News." Yes, our scientists are striving to conquer disease, but is



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this an attempt to conquer nature as a whole? Is the latter what we are really after? Is this a true representation of *Science Digest's* policy?

I would also like to comment on a letter by E. Marquis, published in that issue. Very little nicotine found in a cigarette actually gets into the system. It is almost all burned up as the cigarette is smoked. And it's a good thing too. Nicotine is a very poisonous substance which in pure form is used as an insecticide. The amount of nicotine that can normally be obtained from a cigarette would make anyone very sick or kill him.

PETER HALLOCK
Indiana State College
Terre Haute, Ind.

Ohio University

Ohio University was pleased to note in your September issue the publication of "Bowling in the Classroom," an article on the laws of conservation of momentum by Prof. Charles Randall.

I call to your attention, however, a mistake in the credit line. Dr. Randall is a professor at Ohio University, not Ohio State University.

To distinguish between the two universities, it would perhaps be helpful to point out that Ohio University is located in Athens, and Ohio State University is in Columbus.

Also of interest is the fact that Ohio University is the oldest institution of higher learning in the Northwest Territory, having been established in 1804. We have an enrollment of 12,000 on campus, 6,000 in branch colleges.

MRS. PEGGY SHERIDAN
Ohio University
Athens, Ohio

Thumbs Down

I have subscribed to *Science Digest* for five years, and have thoroughly enjoyed every issue until recently. When I first started taking the magazine, you presented the facts fully and unshaded, leaving the reader to draw his own conclusions. Recently, however, you have allowed the writer to over-inject his own opinions.

The "Hugh Downs Column," is an excellent example of this. What qualifies him to write on aero-space, auditory perception and human relations? All he can write about is what others have told him. This puts his articles on the same level as a gossip column.

Fortunately *Science Digest* is still 70 percent good. . . .

GARY T. MILLER
Palatine, Ill.

Hugh Downs, as a columnist, believes the implications of science matter as much as its facts. We believe so, too. Thank you, anyway, for the 70 percent nod.—Ed.

Neutron stars

In the article "The Amazing New Objects in the Sky" (Sept. '64), you state that the Air Force discovered a neutron star in the Constellation Scorpius and a smaller one in the Crab Nebula. The Navy (as reported in "Science in the News" in the same issue), it seems, could not find one in the Crab Nebula.

LEROY DOCKTER
Grand Forks, N. Dak.

In 1952, the Air Force discovered strong X-ray sources in the Crab Nebula. This seemed to confirm the

thirty-year-old neutron star theory. However, on July 5, 1964, the Navy sent up a research rocket with an X-ray detector aimed at the Crab Nebula. The date was chosen because it was one of the times when the nebula is eclipsed by the moon. The moon, in effect, acted as a shutter for the detector. It was expected that if a neutron star existed, the X-rays would be cut off abruptly as the moon eclipsed it. But this did not happen. Instead, the X-rays fell off gradually, indicating that the radiation is coming from the clouds of gas in the nebula not from a single neutron star. Results of the Navy experiment were not released until after our "Amazing New Objects in the Sky" article went to press. In "Science in the News" ("The Late Science News," starting with this issue), we try to keep readers posted on the last-minute developments, like this one—Ed.

Dead or alive

In reference to your review of Robert C. W. Ettinger's book, *The Prospect of Immortality* ("Should We Freeze the Dead?" Aug. '64), are you kidding'?

I thought that when the brain was deprived of oxygen for a period after death, then revived, as in the cases of some persons who had been revived after drowning, the brain was unable to function normally.

Now, if they knew a person was going to die—say of cancer—and froze him, before death, then when an actual cure of cancer was found, slowly revived him and gave him a shot, or whatever the cure was, thereby saving his life, that would be different.

MRS. RUTH KISSEL
Tennyson, Ind.

PLAGUE OF FLORIDA AND CALIFORNIA

It's the phenomenon known as the "red tide," in which millions of microscopic plants infest the sea, using up the oxygen and killing fish by the ton.

by Nellie Becker Slaton

MYRON and Josie danced in and out of the waves at Redondo Beach, California. They shrieked with joy when the waves caught them and slapped them down against the damp wet sand.

The game ended abruptly when Josie spied a dead fish next to her.



Wide World

Bloated dead fish at St. Petersburg, Fla.

Then her brother Myron caught a dead fish as it floated past him.

About 150 yards away from the children flowed the "red tide." The dead fish were the victims of non-toxic dinoflagellates crowded together in dense masses, giving a rusty hue to the waters.

Most tropical and semi-tropical coastal communities seem to be

The pest of the sea can color coastal waters greenish-yellow as well as red.

faced with this problem. California, Texas, Florida, Peru, New Zealand, South America, Africa, Asia and some parts of Europe have all had their headaches with the "red tide." In fact, the Red Sea and the Vermillion Sea (now Gulf of California) received their names from this dinoflagellate.

The nontoxic "red tide," *Gonyaulax polyhedra*, doesn't interfere with the fun and frolic of Southern Californian bathers. The small number of fish that occasionally wash ashore are harmless. Although humans are not bothered, the tide is a disaster for marine life.

Here's what happens:

When the weather gets unusually warm and the waters are very fertile due to upwelling of nutrients from the bottom of the ocean and other conditions, these one-celled dinoflagellates begin to reproduce rapidly by splitting in half about every half hour or so. Scientists call this phenomenal reproduction the "red tide bloom."

"Here in Southern California," says Dr. Wheeler North of California Institute of Technology, "*Gonyaulax polyhedra* can get up to about 30 million per cubic inch in dense 'bloom.' At night they use up all the oxygen in the water, causing other organisms to suffocate."

A life guard says that at its height of destruction, the "red tide" gives off a terrible fishlike odor. Not long

ago, residents of the Santa Monica Beach area complained of a hydrogen sulfide odor.

Driving along the coast of California past the beach communities of Santa Monica, Manhattan, Hermosa, Redondo and Palos Verdes Peninsula, one can see distinct wide ribbons, like rusty streams, of "red tide." In between these streams and surrounding it are the bluish green waters of the Pacific Ocean.

Half plant and half animal

Scientists at Scripps Institute of Oceanography at La Jolla, Department of Fish and Game at Terminal Island, San Pedro, and the Alan Hancock Foundation of U.S.C. have studied this peculiar creature that is half plant and half animal. Like a plant, it can manufacture its own food by photosynthesis. Or it can forage for food like an animal. "Dino" is derived from a Greek word meaning "terrible," and flagella are whiplike parts.

If you placed a dinoflagellate under a microscope, you wouldn't see its red coloring, but hundreds of them massed in a body of water give off this brownish red hue. They are very delicate and it's difficult for the scientists to keep them alive in the laboratory long enough for extensive study.

The creature spins itself around in the water with the aid of two hair-

like flagella. One acts like a tail at the end of its body, the other lies in a groove around its middle. This middle flagellum moves in a waving fashion and causes the cell to rotate along one axis. So each flagellum can cause this creature to have a variety of movements.

These nontoxic dinoflagellates are enclosed in an armor of cellulose covering, while most but not all of the toxic dinoflagellates are what the scientists call naked. Actually the dinoflagellates are one of three groups of the plankton family. Plankton are considered the "grass" of the sea. It must seem a rude shock to these sea animals when the "grass" that they depend on for food suffocates or poisons them.

The toxic "red tide" inhabits the waters off Florida and San Francisco on out to the Aleutian Islands. The genus around San Francisco is called *Gonyaulax catenella*.

Shellfish poisoning

Mussels, clams and other filter feeders feeding on this plankton don't die, but the concentrated poison in their tissues causes any man or animal eating them to succumb to paralytic shellfish poisoning. The California State Public Health Department posts signs forbidding the eating of mussels, clams and other shellfish from May through October, though occasionally an unmindful person will insist on digging for shellfish on the beaches in August.

That's why traditionally people don't eat oysters in the months that

don't have an R in them, especially the summer months.

Marine scientists at the University of Miami and the Research division of Salt Water Fisheries in Florida have been doing extensive research on the "red tide" since 1947. Other universities in Florida, notably the Universities of Florida and Tampa, have had individuals studying this problem.

Florida got more than its share of publicity in 1947 and again in 1959 when toxic microscopic organisms of the species called *Gymnodinium brevis* wreaked a wave of destruction, coloring the coastal waters greenish yellow, then red. The tiny creatures secreted a liquid that was poisonous to the fish and caused the water to become viscous and slimy. Millions of fish were piled on the shores of Florida, dead from the toxic "blooms."

It is said that "red tide blooms" after the heavy rains in Florida have caused run offs from phosphate-rich areas to flow into the Gulf. But marine scientists in Florida disagree with this theory. They found "that phosphorus is toxic to the organism that causes 'red tide,' so it doesn't directly stimulate its occurrence." They agree that it could possibly bring about a large production of some intermediate organism that might produce some of the essential growth substance of the "red tide."

These scientists are concentrating their attention instead on the vitamin B12 which they feel is one of the nutrients *Gymnodinium brevis*

needs for its sudden "bloom."

In a bulletin issued to reporters, Robert Ingle, Director of Research and Assistant Director of the Division of Salt Water Fisheries, Florida State Board of Conservation, referred to an irritating gas emanating from the "red tide," but he indicated that its effect is temporary.

Professor James Fraser in his book *Nature Adrift* states that a wind-blown spray from these noxious dinoflagellates can be irritating to those with chest or heart troubles.

All such thoughts vanish when on a balmy night these phosphorescent dinoflagellates light up the waters. But neither *Gymnodinium brevis* nor the *Gonyaulax polyhedra* shine as brightly as *Noctiluca scintillans*. Sailors and travelers on ships churning through tropical waters at night, have often noted how the vessel's movement caused the *Noctiluca* to sparkle brightly. In the daytime, this particular dinoflagellate when it "blooms" looks like a "pink lady" cocktail floating on the waters.

Dinoflagellates aren't the only culprits to turn the water red. In fact not all dinoflagellates create this condition. Scientists believe that sometimes purple bacteria or sulfur bacteria can also cause red water to give off the hydrogen sulfide odor. This usually happens after the "fish kill" and the "red tide blooms" die; then the bacteria take over to convert the dead material into food for other creatures in the sea. They also oxidize the hydrogen sulfide.

Purple bacteria can also occur

without a "red tide," when there is little tidal mixing, the weather is extremely warm and fertile, stagnant waters cause the oxygen in the water to go down to "0."

Dr. Claude ZoBell of Scripps Institute of Oceanography says that the "red tide" can be caused by bacteria, algae, diatoms, ciliates and flagellates. Rotifers, protozoa with one red eye, have caused the coastal area around New Zealand to turn red. These are nonpoisonous.

Sometimes the sea turns milky

Dr. Wheeler North says you can also get green tides and yellow tides. I also heard that another plankton *coccolithophores* turned the water a milky blue. Some fishermen call it "white water."

From the spring of 1962 to the spring of 1963, Southern California had an unusually heavy "bloom" of "red tide." During that time, Dr. Donald Reish, associate biology professor at Long Beach State College, studied the "red tide" and its effects on the fish at Alamitos harbor at Long Beach, California. Dr. Miki-hiko Oguri and his associates at the Alan Hancock Foundation of U.S.C. made several trips to the shores of Southern California beginning in September, 1962, through the spring of 1963. Like other marine microbiologists the world over, they tried to analyze the "red tide."

"It used to be that when the 'red tide' appeared in the spring," said a local life guard, "it would reach its height in August and September,

then gradually recede in October or November. But now Californians can see patches of rusty 'red tide' all year round." The "red tide" is also normally present in small numbers on the lower west coast of Florida throughout the year.

Dr. R. W. Holmes of Scripps Institute of Oceanography said that "our local 'red tide' of May, 1964, was largely caused by a different *Gymnodinium* species. . . . There is yet no evidence that this species was toxic."

The weekend of May 17, 1964, found the management of the new Sea World oceanarium at Mission Bay in San Diego, California, very unhappy when the destructive "red tide" maneuvered its way past the filtering systems and caused the death of about six of the twenty yellow tail and the oceanarium's

only pilot whale, which measured 14 feet. Admission prices were lowered for adults and children because of cancellations of four of their eleven shows. Engineers worked feverishly to remove the dinoflagellates from the filtering plant before they entered into the tanks in which the acts were staged.

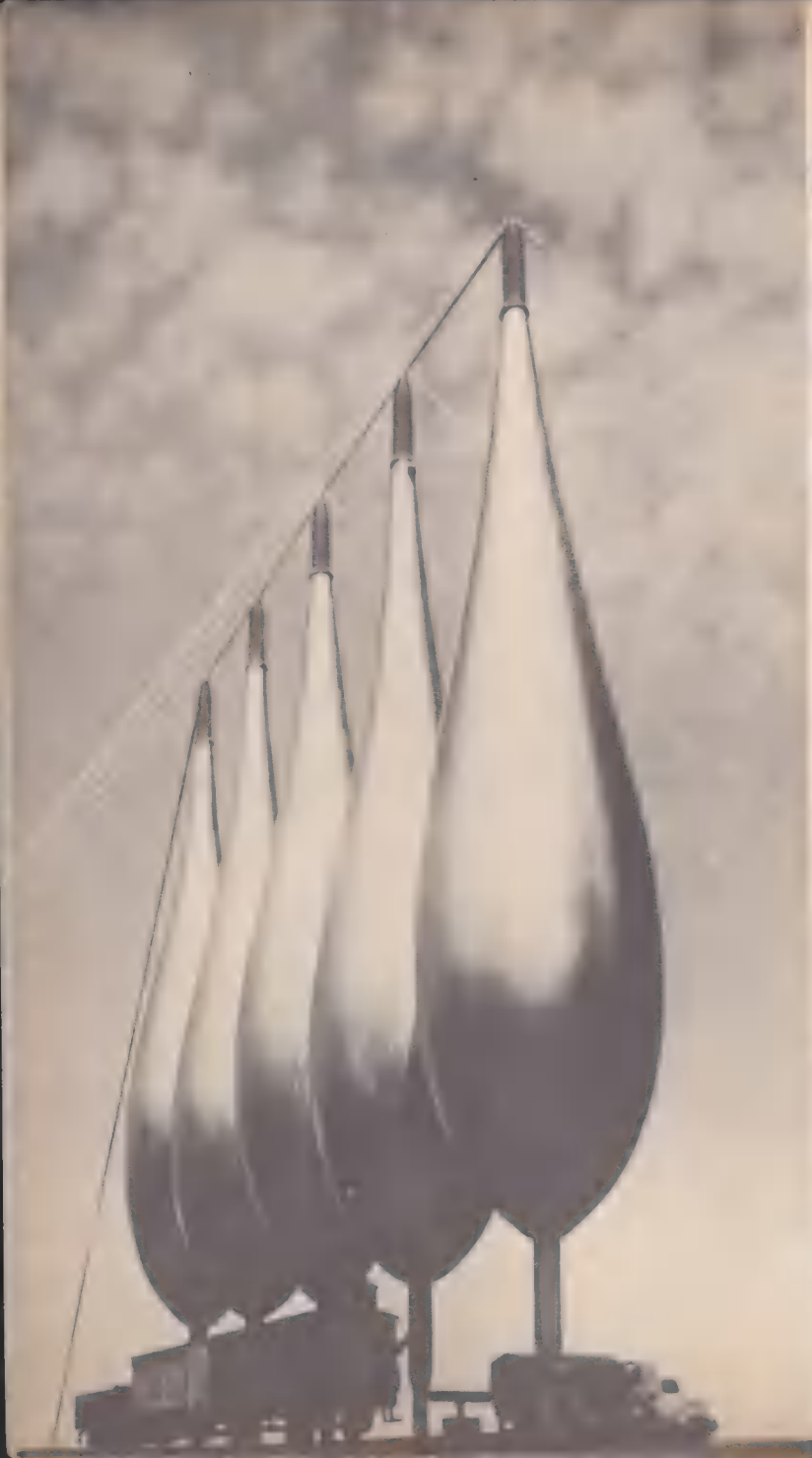
While some marine microbiologists attempt to study the habits of this wiley, voracious half animal and half plant in the laboratory, other scientists dredge the waters with scientifically equipped boats. They are all looking for answers to the same questions:

What causes the "red tide?" How can we control it?

The answers would make fishermen, businessmen and people who enjoy the beach along tropical and semi-tropical coast lines very happy.

'64 "red tide" kill worst in 20 years

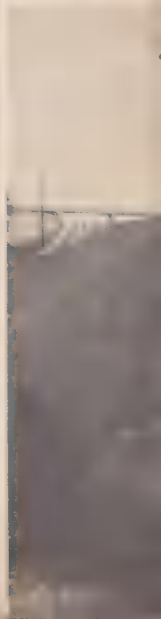
According to oceanographers and lifeguards along Southern California coasts, the "red tides" of August, 1964, claimed more victims than at any time during the preceding twenty years. At Mine Pack Lagoon, California, the death of more than 100 tons, or 5.6 million fish, was caused in one week by the proliferation of billions of microscopic plants known as *Gonyaulax polyhedra* and *Gymnodinium brevis*. Another five million dead fish were reported floating off the shore of Marina del Rey. The California State Fish and Game Commission attributed the unusually large kills to high water temperatures and sewage wastes released into the areas. The sewage wastes provided nutrients for the "red tide plants," and caused them to "bloom" until they had exhausted the supply of oxygen necessary for fish to survive. The oxygen content of the water at Marina del Rey was reported at 2 parts per million parts of water at the surface, and less below the surface. Normal surface oxygen content of ocean water is at least 7 ppm.



Danzelsen & Voser

Ernst Otto

Highways and Bridges
Wakefield, England

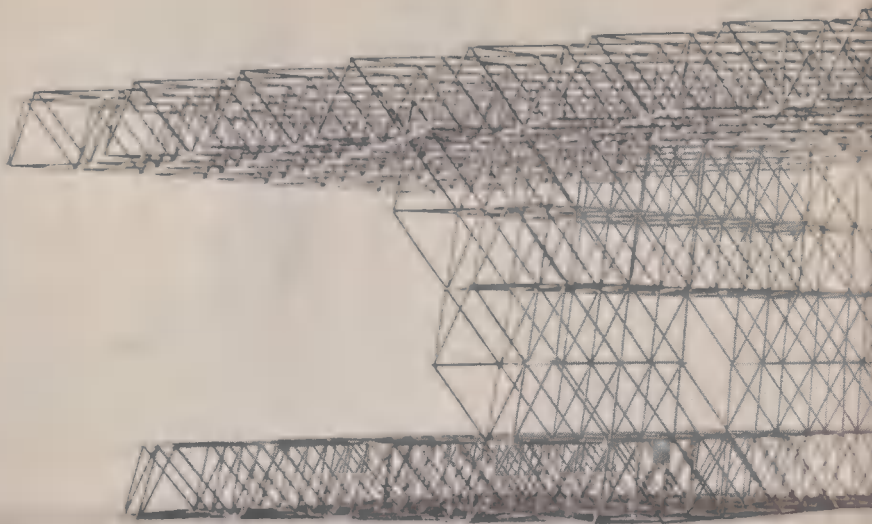




The beauty of 20th century engineering

Purely utilitarian structures can be works of art. The Museum of Modern Art in New York proved this in an exhibition of 20th Century Engineering. Photos on these pages are from the exhibition. Left, hanging flexible silos, Berlin, designed by Frei Otto, 1960. Above, Gold-Zack fabric plant, Gossau, Switzerland, by Heinz Hossdorf, 1954. Below, Wentbridge Viaduct, near Doncaster, England, by Maynard Lovell, 1961.



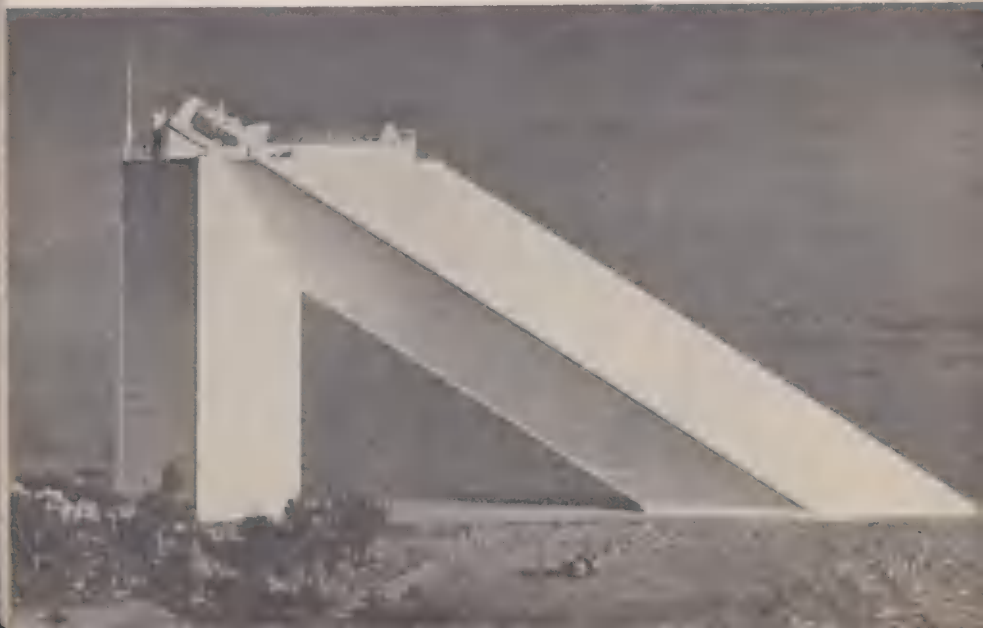


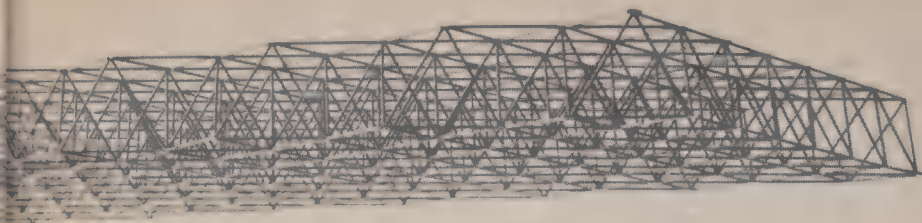
George Barrows

Octet Truss cantilever structure, The Museum of Modern Art, New York, designed by R. Buckminster Fuller, 1959. (See Science Digest October, 1964, "Inventor of the Month.")

Association of Universities for Research in Astronomy, solar observatory tower, Kitt Peak, Arizona, designed by architectural firm of Skidmore, Owings & Merrill, 1962.

Ezra Stoller Associates





Parco del Valentino exhibition hall, Turin,
Italy, designed by Riccardo Morandi, 1959.

Riccardo Morandi





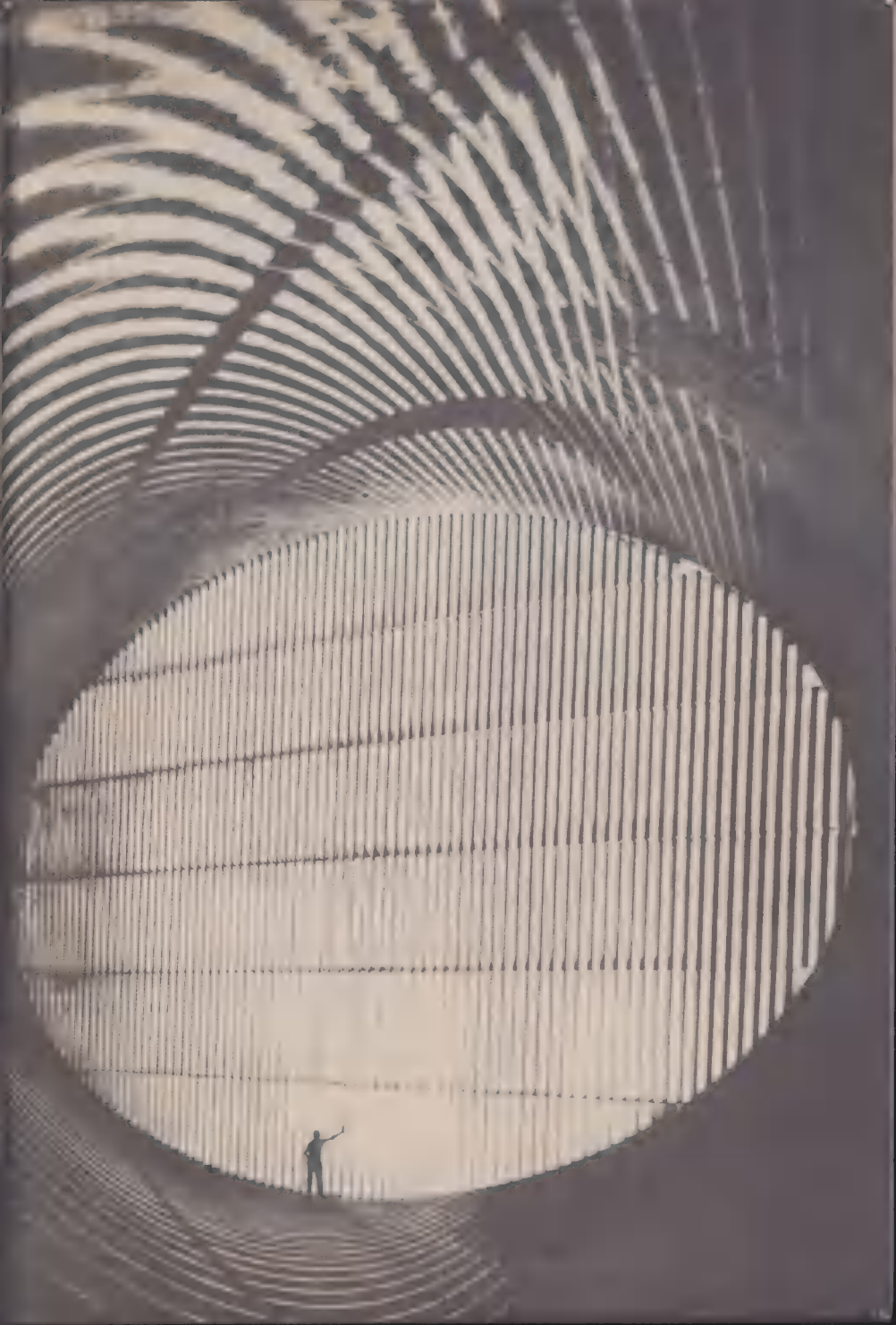
Gutehoffnungshütte

Above, Severin Bridge over the Rhine River, Cologne, Germany, by Gerhard Lohmer, 1959. Below, Union Tank Car Co., car rebuilding plant, Baton Rouge, La., by R. Buckminster Fuller, 1959. Right, NASA Langley Research Center, transonic wind tunnel, Hampton, Va., by NASA, 1961.

R. Buckminster Fuller

NASA







Jobs of the future

Traditional ideas that a single skill is enough for lifetime employment are outmoded. Now it's likely that a person will have to learn two or three occupational skills during his working life. Those who prepare now for the revolution in employment will be the leaders in tomorrow's more fiercely competitive world.

by Peter Haase and
Frank Lynn

RADICAL innovations in technology have always caused serious changes in an industry's working force. Current discussion on such changes have centered on automa-

tion, that is, the replacement of muscle power by machine power with the consequent reduction in size of the working force. Another aspect of this problem will soon become more evident—the technological displacement that occurs when new processes are developed which, by their nature, completely eliminate manpower requirements that formerly existed.

In the electronics industry, for

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IBM Photo

Technological innovations will cause the number of female workers in electronics to drop substantially in 10 to 20 years.

example, this kind of displacement will soon become widespread. With conventional circuitry, individual components are assembled and wired together to form a complete circuit. Even with printed circuit techniques, a considerable amount of manual labor is still needed in the manufacturing process. With the introduction of integrated circuitry, however, individual components are eliminated and the entire circuit is integrated into a single miniaturized component. Since these circuits must be manufactured in ultra-high vacuums under rigidly controlled conditions, integrated circuits are expected to cause substantial technological displacement in the labor force of the electronics industry during the next two decades.

Superficially, the difference between the elimination of jobs by the automation of production and by the introduction of a new technology may appear to be slight. Actually, they represent entirely different types of problems and call for different types of solutions.

The displacement of workers through automation is a process that ordinarily goes on continuously throughout an entire industry and generally affects only a few individuals at a time. Typically, displacement is concentrated in semi- and unskilled job areas and is difficult to anticipate without prior knowledge of an individual company's production and facility planning programs.

Technological displacement, on the other hand, affects large numbers of workers within a given industrial or occupational area during a relatively short period of time (perhaps five years). Moreover, technological displacement can be more easily foreseen. Its effects, however, extend beyond semi- and unskilled workers and reach into the skilled labor force: white-collar workers, engineers and even to company management.

Requirements changed

Any number of examples will serve to demonstrate the breadth of this type of displacement. In the office industry, the expanded use of automatic data processing equipment will drastically change traditional manpower requirements. A

The number of skilled machinists and tool and die makers is expected to decline from 350,000 to 200,000 in 1980, despite industrial growth.

recent report issued by the U.S. Department of Labor deals with the impact of office automation on the Internal Revenue Service and provides a valuable insight into the structure of the office industry as a whole. The report cites the following:

Initial planning of the new automatic data processing system required three years to complete; the actual installation is expected to require an additional seven years.

Of a total employment of 40,898 workers, it is estimated that 10,901 employees' jobs will be directly eliminated by a comprehensive, automatic data processing system.

Total office employment in the system is likely to increase by 40 to 50 percent as a result of the substantial increase of informational output from the system.

For every four employees' jobs that were eliminated, approximately one new automatic data processing job was created.

Nearly 60 percent of the new automatic data processing jobs created were in job classifications that called for an annual salary in excess of \$10,000 per year.

The number of keypunch operators is expected to increase by 400 percent with the introduction of this new system.

Of a total of 1,060 employees' jobs that were eliminated in one

regional office, 83 percent were held by female workers.

Through technological innovations, the number of female workers in the electronics industry will drop substantially within the next 10 to 20 years. With these changes in the electronics and office industries, this country may experience—for the first time—a great oversupply of female workers in the labor force.

In the metalworking industries, numerical control and new electronic metalworking techniques will combine to eliminate many skilled machinists and tool and die makers. The skilled machine operator can be replaced by a semi-skilled operator whose primary function is to monitor the operations of a machine. As a result of this technological displacement, the number of skilled machinists and tool and die makers is expected to decline from 350,000 in 1960 to 200,000 in 1980—despite a 3.5 percent anticipated growth of the metalworking industries each year during that period.

Within the printing industry, the development of computerized typesetting techniques and photo-composition equipment is expected to reduce substantially the need for linotype operators and other highly skilled personnel in the composing room. In this industry, as well as in the metalworking field, one of the strongest motivations for introduc-

ing new technology is the relatively high cost of skilled labor.

The problem of technological obsolescence also extends to engineers who received their degrees as recently as 10 years ago. Nowhere is this impact more evident than in the electronics industry, where electrical engineers who had received their training in the traditional areas are finding themselves unequipped to work within the new areas of electronic circuit technology.

To compensate for the occupations and skills that technological innovations will make obsolescent, many new existing occupations are likely to be in short supply during the next 10 to 20 years. The most serious of these manpower shortages will probably appear in the office industry as a result of the expanding use of automatic data processing equipment. For example, there were 40,000 computer programmers employed in business, industry and government in 1960; between 200,000 and 300,000 computer programmers are likely to be needed by 1970. A similar shortage of keypunch operators is expected.

Present occupational concepts, which have their foundation in the craftsman philosophy of the 1880's and which were re-emphasized during the depression of the 1930's, are based on the premise that a single occupational skill is sufficient to provide a lifetime of employment and income. This traditional concept is being eroded by the increasing pace of technological change in our society. It is probable that a person

now entering the labor force will have to learn two or three occupational skills during his working life.

This changing concept of occupational skills will place a new burden on our educational systems. Courses will have to provide students with a knowledge of fundamentals that are applicable to a large number of occupational areas rather than concentrating upon detailed knowledge in only one area. This approach is especially significant for high school vocational and business courses where technology is expected to have the greatest effect in accelerating occupational change.

The office industry

The office industry, for example, has traditionally offered the male high school graduate a fine opportunity to gain entrance into the business field, since many of the present routine clerical and record-keeping jobs in the office can be performed by a reasonably intelligent high school graduate. From this starting point, young men have been able to gain the knowledge and experience for better job opportunities in accounting, finance, sales and office management. The introduction of automatic data processing equipment will eliminate this foothold for advancement. An average high school education will no longer suffice for those who want to enter and progress in this field.

Despite the changes that are expected in high school and college education within the next 10 to 20

years, the greatest impact will be felt in adult night school education. Although business and industry will be forced to increase their worker training and retraining activities, it is most probable that a substantial portion of retraining in new occupational skills will have to be provided by adult, night-time programs. By 1980, night school might very well become an accepted part of the weekly activities of a large segment of this country's labor force.

The growing need for adult, night school education poses several serious problems, particularly for educational systems in urban areas where most technological displacement will be concentrated. Not only will school systems face the problems of supplying adequate facilities and teachers to meet the expanding needs of night school programs, but they will also be faced with the more difficult problem of trying to provide adequate education and training in entirely new skills and occupations which are not well defined and which are in a constant state of flux.

Night school programs

Night school programs in colleges and universities are now inadequate for the great needs which will soon develop for enlarged occupational training. Most night school courses at the college level are an integral part of degree programs and are therefore not readily available to those interested only in furthering their personal knowledge in a par-

ticular field. Colleges and universities—especially those in urban areas—may thus have to increase the number of their non-degree educational programs or perhaps to develop new relationships with local schools so that college-level programs can be provided through existing night school systems.

Hopefully, technology may also be able to provide some of the solutions to the educational problems outlined here. The continued development of programmed learning concepts and equipment may eventually enable individuals to acquire new skills and receive training in their homes. Another answer may lie in the three-month sabbatical vacation that was recently inaugurated in the steel and container industries. Workers could obtain new education and training if they attended vocational or other schools on a full-time basis during this period. Either or both of these alternatives might help reduce the growing problems of occupational obsolescence. The new technologies that have been developed since World War II, largely through research and development expenditures of the federal government, are being introduced into industry on an increasingly larger scale. Within the next 20 years, traditional industrial practices and intracompany structures will be greatly modified—producing a new kind of worker and a new kind of manager.

Those who prepare now for this quiet revolution will be the leaders in tomorrow's world.



Three Lions

Camelus-dromedarius, the Arabian or one-humped camel.

The compleat camel

Many stories about the camel have been exaggerated—but the truth is remarkable enough.

by Dal Stevens

NATURE, that great architect-designer, never achieved anything better than *Camelus-dromedarius*, the Arabian or one-humped camel, for the crossing of the great deserts of the world. It is in fact, the compleat animal.

First, it has very remarkable feet. These are large and flat with smooth soles of almost flexible horn which are superbly suited for moving over loose sand into which other kinds of feet would sink.

Then, too, it has a long curved neck which helps it to reach up and

feed off the branches of trees to augment its feeding off grasses and low-growing shrubs.

Nature must have put some very hard work in on the drawing board to give the camel's eyes protection against windblown sand and the harsh glare of the sun. The camel has heavy brows and long lashes to shield its eyes from the blown sand and to cut out some of the glare. And the iris of the eye has tooth-like folds which hang down as curtains over the pupils!

Again, the nose is something special. The nostrils are slit-like and are controlled by special muscles so

One of the racing camels of Arabia carried a messenger 530 miles in two and a half days with news of a Turkish defeat. It died on arrival.

that when a sand-storm comes up the camel can contract the openings of the nostrils to a comparatively small size, keeping out the sand while allowing the animal to breathe.

The camel's lips, too, are remarkable. The upper one is cloven and very sensitive, which helps the camel to pick up grains of corn or leaves on the ground.

The camel's mouth is particularly notable. It is apparently insensitive to pain. That is a big asset, enabling the camel to eat many of the spiky desert plants, which may contain as much as 80 percent water, that many other animals would not be able to swallow. It passes spiny plants quickly through its mouth without injury. The secret may be in an unusual palate which has many folds and is large and pleated. But, again, the palate may be designed this way to keep the camel's mouth moist. It is probable the palate accomplishes both purposes—and others, as yet unknown.

There are many secrets about the compleat camel that have yet to be unravelled. For instance, what about the famous hump, which is believed to store water, or the equally widely accepted theory that a camel stores water in one of its three stomachs?

The camel's supposed ability to

store water in one of its three stomachs is cited in one recent authoritative work on natural history.

But there is, apparently, no truth in the belief that camels store water in their stomachs. The belief is discounted by a Capt. A. S. Leese, a veterinary surgeon and for many years a camel specialist in the East, and also by very recent research. In his book on the camel, Captain Leese says, "There is a fable that these water-sacs are able to store a quantity of water which, when necessity arises, can be brought up into the mouth to quench thirst, and that, moreover, thirsty travellers have been able to save their lives by killing their mounts and cutting the water-sacs open, therein finding water to restore themselves; these stories, like many other tales about the camel, are exaggerations." Captain Leese thinks that the water-sacs are there merely to supply fluid to moisten the food before it goes to the mouth for a final chewing.

Neither is water stored in the camel's hump, which consists of fat on which reserve the camel is able to draw during long desert marches.

It is just possible that the camel can draw on this fat by making metabolic water as some desert creatures do. Some desert creatures store water in the form of fat in their bodies; the water is released by the breaking down of sugars and

other carbohydrates or by the oxidation of the hydrogen or carbon. (No one knows, as yet, whether the camel does this.)

The reason for the camel's ability to go without drinking for an unusual period under certain conditions, are, they think, these: its body temperature can vary widely and it can tolerate great dehydration. During hot weather and under exertion, most animals must lose moisture through perspiration in order to keep their body temperature within a certain range. The evaporation of sweat has a cooling effect. We, for instance, only function well when our bodies stay within about one degree of 98.4° . When temperatures get high we sweat faster and lose more moisture. The camel doesn't have to sweat nearly so hard to prevent its body temperature rising. It simply absorbs heat during the day and gives it off at night. Its temperature can vary from about 93° just before dawn to 104° in the afternoon. The camel can't get away without sweating but it does so at a much slower rate than most other animals. If it was carrying heavy loads during the heat of the day it might lose quite considerable amounts of moisture. We can lose water amounting to about 10 percent only of our body weight; a camel on the other hand can lose water to more than 30 percent of its weight without loss of strength.

The great architect-designer has also given the camel a special kind of blood. The camel loses very little fluid from its bloodstream when it

does not drink for days at a time. Without a regular intake of water, the blood of other animals, including man, becomes so thick that finally the heart can't pump it through the system. The camel's red blood cells are oval and not round like those of most animals; they are much tougher than those of other creatures and have a different sodium and potassium content.

Adapted to desert life

The camel's ability to exist without food or water has been considerably exaggerated but the truth is astonishing enough. Because it is so wonderfully adapted to desert life, it can carry heavy loads for as long as four days without water. And there have been cases in Arabia of loaded camels continuing for six and eight days without drink. On one occasion loaded camels travelled for 17 days, averaging 23 miles a day, with no more than one drink throughout that time.

Not only endurance but speed is recorded of several of the racing camels of Arabia. A messenger on a riding camel in 1915 travelled the 530 miles between Shu'aiba, near Basra, to Zubair in two and a half days, with news of a Turkish defeat. The camel died on arrival.

Again, when Shaikh Naif ibn Humaid escaped from prison in Riyadh in about 1925, he reached Nasriyah in Iraq in eight days, riding one of the best racing camels of his tribe. The distance was close to 800 miles.

WHAT JOHNNY SHOULD LEARN BEFORE SCHOOL

Children from many homes are lost to education even before they enter the first grade. The author, Nobel Prize-winning geneticist and president of the University of Chicago, concludes that our educational system is missing the boat by not trying to reach children during these vital, early years.

by George Wells Beadle

THIS SUMMER as I left our house on the campus I saw a young lady briskly walking down the sidewalk, followed at a distance of a yard by a half-grown duck.

The duck had been "imprinted," that is, had "learned" in a special way to regard the young lady, Diane Hillard, as its mother.

I later found that Diane is a graduate student in psychology. The first moving object the duck had seen a few hours after birth was Diane. It was an example of classical imprinting—a special kind of learning which takes place in birds, and possibly in other creatures, during a short, sensitive period which in birds is soon after hatching.

Like the duck, we, too, begin to learn very early in life, maybe in part by imprinting, but certainly in many other ways as well. It has re-

cently become increasingly clear that early learning is much more significant than we have previously thought.

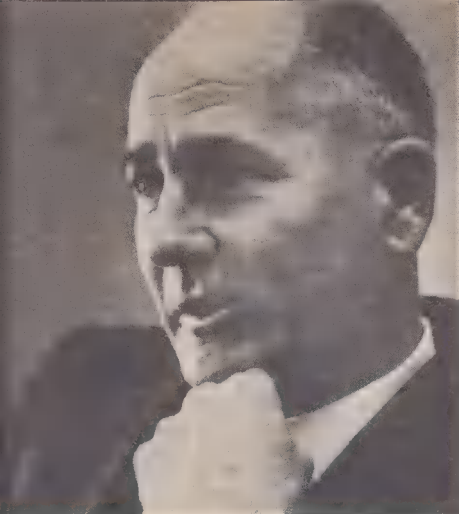
Learning, of course, involves the mind, which for our purposes we can say is synonymous with the brain, and which finds expression through other parts of the body.

Aside from the soul, which so far has remained more in the province of poetry-philosophy-theology than in that of science, and which no one seems able to define precisely, the mind is by far the most important respect in which man differs from all other animals.

It is the means by which we acquire knowledge, appreciation of art, music and literature and understanding, all of which go to make up our culture. We acquire these and other parts of our culture from previous generations, from fellow men of this generation and from our own individual experiences.

Despite our extensive knowledge of the brain and the other parts of man's nervous system in terms of

This article is adapted from George Beadle's convocation address delivered at the 306th convocation of the University of Chicago.



George Wells Beadle won the Nobel Prize in Medicine in 1958 for work in genetics.

must be present, plus food—some 10 to 20 tons of it to produce a fully grown person—plus proper environments before and after birth.

Today's college graduates all know that this molecular information is deoxyribonucleic acid, or DNA for short. So do high school youngsters these days. We of the older generation may be less fortunate, for most of this remarkable new knowledge of DNA became known after we had passed through our most active period of learning.

cellular structure, grosser anatomy, physiology, biochemistry and psychology, we know very little indeed about some of its most important attributes.

Interestingly enough, we do know in remarkable detail how the primary specifications for constructing a human mind or brain are written. These are in one sense our evolutionary memories. They indicate how we develop and function. They are written in a remarkably simple molecular code.

This is a kind of "language" written in an "alphabet" in which each "letter" is a specific arrangement of some 30 atoms of five kinds. The words in this genetic language are all three-letter words, and the "dictionary" consists of 64 words.

These hereditary specifications are found in the central nucleus of the egg cell from which we all develop, and consist of some 1.7 billion submicroscopic words.

These 1.7 billion three-letter words are by no means all of the information necessary. Cytoplasm

RNA messages

The DNA messages in the nucleus of the cell are copies in a closely related type of molecule called ribonucleic acid, or RNA. RNA messages are essentially like those of DNA, and they carry the essential information out of the nucleus of the cell into the cytoplasm, where it is used in directing the chemical reactions that are an essential part of life processes.

Experiments involving RNA suggest the possibility that information may be recorded in the brain in the form of an RNA code. RNA is certainly involved, for no viable nerve cell could survive and function without RNA. To me, and to others who know much more about it, however, it seems most unlikely that the order of subunits of RNA is directly re-arranged when information is recorded in the brain. Other possibilities have by no means

50 percent of general intelligence seems normally to be achieved by age 4; and 50 percent of general school learning, by about age 9.

been ruled out. About all we can say for sure is that this is a most significant area of investigation for the next generation of biologists.

DNA instructions

Not all the information in the brain need be put in from the outside. Some is built in during normal development according to DNA instructions. This is the innate information that is the basis of instinctive behavior.

Let me give you some examples.

A spider does not learn to build a delicate and often beautiful web of a kind characteristic of her species. She does it according to inherited DNA instructions that pass through her computer-like brain. It is a largely automatic process. The spider cannot learn to make a different kind of web. In a given situation she responds in a stereotyped way. She cannot create new and novel designs as can a human architect.

Some of you know the amazing story of how a female wasp of ■ so-called solitary species stings and paralyzes its insect prey, drags it to an intricately designed net, deposits an egg on it, carefully seals up the nest and goes off to let the young hatch, prey on the host which is preserved in a living state and change from a wormlike grub into

a delicately constructed and beautiful adult like one of its parents. It is all done through inherited DNA information, with no indication that the wasp needs education in the sense in which we know it.

We do know, however, that some insects can learn, for one can teach a honey bee with a brain one-10,000th or less the size of ours to follow a precise time schedule in coming for nectar. She can be trained to come on the hour for as many as five successive times per day. If we had schools for bees, these creatures might be taught much more.

All animals, including us, have such built-in, instinctive behavior patterns. DNA-directed, built-in behavior patterns of this kind are subject to modifications, sometimes remarkable ones.

Getting back to that duck, even if we do not know exactly what imprinting occurred, it is clear that it happened early—a few hours after hatching. Not only did it happen early, but it had to happen early or it would not have happened at all.

There are many other examples of early influences on the mind and subsequent behavior. Whether or not young adult male mice will fight depends on early influences. Male mice, reared singly prior to weaning and in isolation thereafter, quickly fight if placed together in

pairs. In dramatic contrast, mice otherwise comparable, but singly adopted by rat mothers and reared with the rats' own young during and after nursing, later show no interest in fighting when placed together in pairs.

Moving up the evolutionary scale, it is well known that baby monkeys reared in isolation, with all physical needs adequately met, become so emotionally disturbed that at maturity they are psychologically incapable of normal reproduction. As with the newborn of our species, parental affection is apparently an essential part of normal development. Behavioral difference in baby monkeys can be detected even between those born normally and comparable animals delivered by Caesarean surgery.

Early influences

Such early influences on development are more difficult to identify in our own species, for obvious reasons, but there can be little doubt that they occur. Prof. Bruno Bettelheim of the University's Orthogenic School has achieved spectacular success in correcting severe emotional disturbances in children, in some cases initially so extreme that the affected individuals have been thought to be mentally retarded. Apparently nothing organic is wrong in these instances in which correction can be achieved by psychotherapy.

Prof. Bettelheim believes that at least some of these may represent

instances in which something has gone wrong with the mother-child interrelation soon after birth. An inexperienced mother or a mother whose child is unwanted, may react abnormally to the newborn, thus initiating a buildup of successive abnormal interreactions.

Growth and development

Influences of various kinds continue to impinge on a child during growth and development, and often are especially effective in setting behavioral patterns and determining rate of learning during early years.

Prof. Benjamin S. Bloom of the department of education of the University of Chicago has just written a book entitled "Stability and Change in Human Characteristics," in which he presents evidence that 50 percent of general intelligence in children seems normally to be achieved by age 4; an equal amount of aggressiveness in boys by age 3; half the dependency in girls by 4; and 50 percent of general school learning by about age 9. He does not mean that the rate at which these traits develop cannot later be significantly increased if sufficient effort is made to do so.

Findings of the kind I have mentioned strongly indicate that we may be missing the boat in our educational systems, for we largely ignore the most sensitive and receptive period of development.

I wish to bring all that I have said up to now to bear on the very large problem of cultural inheritance

The cultural conditioning that takes place at home and on the street in preschool years cannot be counteracted by the best of schools.

and cultural evolution. We know how genes are transmitted from generation to generation, and the importance of this is widely recognized. We likewise know much about how human culture is transmitted from generation to generation. But I believe we are a long way from appreciating the real significance of the latter.

Cultural transmission

We believe that by requiring a child to attend a formal school beginning at age 5 or 6 we can mold him or her in the cultural pattern of our choice. Our knowledge of the parent-to-child chain of cultural transmission that works so effectively during the preschool years of the child speaks out clearly and eloquently to the contrary. The trouble is we have not listened. I regard it as of the greatest importance that we do so—and soon.

One of the reasons we have not listened is that the culture we represent too often takes for granted our particular patterns of preschool cultural influence. Increasingly we recognize that this way be a wholly unjustified assumption.

Consider a child born into an average family in the middle of New York's Harlem or one of Chicago's depressed Negro communities. The parents are likely to belong to a

subculture of which we are largely ignorant. We might just as appropriately consider subcultures of other groups—culturally impoverished Mexicans in Los Angeles, Puerto Ricans in New York, American Indians on a Navajo reservation, or the 30,000 or so descendants of pioneer settlers of the Appalachian Mountain country who now make up what Hal Bruna, writing in the *Reporter*, calls the "hill-billy ghetto" of Chicago's North Side. The pattern is likely to be much the same in all of these.

The parents are uneducated in the sense we take for granted. Books are few. Music is limited in kind. There are few toys and in the cities no playgrounds except streets. Conversation and activities are primitive. Parental affection may be minimal or non-existent.

Let me paraphrase what Prof. Fred L. Strodbeck of our sociology and psychology departments says about situations of this kind: "These are children to whom home is a room or two in a slum tenement. There may be no father in a family sense and the mother may be burdened with several other children. They learn early that they must make few demands on the mother if they are to expect her approval.

"They live in a frustrating world, not a satisfying one—a world in which feeding is often irregular; a

world in which there are few play-things with which to develop and test a growing sense of mastery; a world in which there is no evidence of the potency of the spoken or the written word.

"Playing verbal games, which is a first step in learning to read, is largely unknown in such families. The mother may consider the only accomplishment of the child worth rewarding is being quiet and making no demands. Such children come to school with few successful learning experiences, either formal or informal, in which they were able to experience the gratifications which come from mastery of a new situation."

Cultural vs. biological inheritance

More equitable distribution of wealth by purse snatching, robbing and bicycle stealing may be rationalized and condoned by some parents. We hope the number of these is small, but we do not know this for sure. From the earliest years the child may be conditioned to resent the culturally favored whose biological inheritance may well be no different from his in essential respects.

Even if the school such a child attends from age 5 or 6 were as good as it could possibly be made, I seriously doubt if the cultural conditioning that takes place at home and on the street in preschool years, and that continues thereafter, can be completely counteracted.

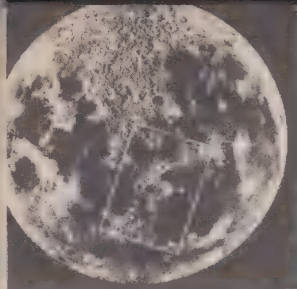
Or turn to a so-called developing

nation that believes it wants to rebuild its culture in the image of ours. Whether or not it should believe this is beside the point: it does. The difficulties are great indeed, in large part because of the unbroken generation-to-generation chain of cultural transmission. The problem is essentially the same as that I have described for the subcultures within our own nation.

I am convinced that the process of change in both situations can be enormously speeded up if we can find ways of replacing or supplementing early cultural experience, especially that prior to normal school age. I do not pretend to know how best to do this, but I am sure it can be done.

I recognize that there may be many difficulties. For example, cultural conditioning of the young child by parents cannot be entirely negated except by removing the child from his parents. And if this were otherwise feasible, can we adequately replace the natural parental affection that may be even more important than we now know? Perhaps supplements are sufficient if we are clever enough to discover what they should be and how to provide them.

But I am sure this approach can be far less expensive in both money and human misery than our present ineffective and costly attempts to provide public aid later in life to the culturally underprivileged, or to attempt to change the cultures of whole nations through foreign aid programs.



Holiday on the moon



Closeup of moon (above) shows boxed area (above left).

"LET'S SEE. We'll spend three days going through the Apennines, then cut south through the Imbrium Sea to the Teneriffe Mountains, stopping at Mount Blanc, and winding up in the Caucasus."

As a dreamer who has spent many hundreds of hours vacationing mentally with a road map spread before me, I found it no surprise the other day when I started doing the same thing with *Atlas of the Moon* spread before me.

This "open sesame" to new adventures in travel, by Vincent de Callatay (St. Martin's Press, New York, \$15), gives you a region-by-region look at the moon's geography and topography with extraordinary clarity and simplicity.

On every "spread" of pages, you get a greatly enlarged photograph of a region on one page, and on the facing page, a picture of the whole moon with the region outlined, so you can see just where it belongs. Also on the facing page, you get a



Map of the moon shows names of mountains, craters, other features.
From *Atlas of the Moon*

map of the region, with all the place names that belong.

It's the place names that stop you. The Apennines and the Caucasus and Mount Blanc are all actual places on the moon, as they are on earth. You can play pioneer, like a settler of the American Far West, and plot trails through the mountains and plains, the craters and seas, just as if you were in a high-flying plane gazing down on new territory.

Altogether, there are 23 fabulous

plates detailing the configuration of the moon. In addition, *Atlas of the Moon* gives you 77 pages of information on the moon, from its eclipses and phases to its atmosphere and its effect on tides. And on top of that, it offers 20 pages of information on how to get there, with a rundown on our Apollo (man to the moon) program.

For a vacation guide unlike any other you've ever seen, get this book. It's sure to get you.—HUBERT PRYOR.



©Nat. Geog. Society

Tiny object, big find

A TINY wheel of carved soapstone, about as ordinary looking an object as can be imagined, is one of the great archaeological discoveries of North America.

Identified as part of a spinning device, the little round perforated object is the first known Viking household article ever unearthed on this continent. It supports the claim, the National Geographic Society says, that Norsemen colonized the New World before Columbus.

The artifact was found by Norwegian archaeologist Anne Stine Ingstad at L'Anse aux Meadows, Newfoundland, a Viking site which has been excavated with the support of the Society.

Present-day L'Anse aux Meadows is a remote fishing village at the northernmost tip of Newfoundland Island. Here Mrs. Ingstad's husband, Helge, a veteran Norwegian explorer, earlier discovered the first proven ruins of a Norse settlement in the Americas (see *Science Digest*, Feb. '64).

Dr. Ingstad uncovered the layered turf foundations of nine long

abandoned structures, dated by radio-carbon as having been occupied in about 1000 AD. Dr. Ingstad believes the community was perhaps founded by Leif Ericson himself, since the area fits the description in sagas of Leif's "Vinland."

What makes this unimpressive little wheel so important is that the Vikings, unlike many early people, were unusually good housekeepers. Also, Viking colonists in the New World faced a scarcity of materials and could not afford to waste anything. This left slim pickings for the archaeologist, who often can develop considerable information from mounds of broken pots or other debris left behind by more wasteful early people.

In the past, several alleged Viking artifacts and structures have proved to be unauthentic.

Mrs. Ingstad says the 1¼-inch-wide piece of carved soapstone served as a flywheel on a wool-spinning spindle. Many similar whorls have been found in Scandinavia and Greenland dating from Viking times in the Middle Ages.

The find suggests that the New World's adventurous visitors brought women who attended to household tasks while their husbands sought—unsuccessfully—to carve out a permanent settlement 500 years before Columbus.

With the reality of a Viking settlement firmly established, President Johnson has signed into law a Congressional resolution authorizing the proclamation each year of Oct. 9 as Leif Ericson Day.



The Charolais breed has caught the eye of cattle experts all over the world.

France's amazing beef machine

Through scientific breeding, one of the world's oldest breeds of cattle may answer the very modern demand for leaner meat.

by Fred E. Breth

ALL LIVESTOCK breeding has two goals: to turn out a product that the consumer will buy and to produce it at as little cost and with as little effort as possible.

The consumer has very definite requirements when it comes to looks, flavor, tenderness, succulence, "cutability" and "cookability" of meat.

Ever since the early 50's, reverberating throughout the North American continent, the housewife's battle cry has been: LEAN, LEAN, LEAN!

To modify the anatomy of an animal not only for one generation

(phenotype) but so that it will "stick" generation after generation (genotype) is a formidable task. Even if the breeder is working with short life-cycle animals (e.g. poultry) such changes—if they can be accomplished at all—may take decades; with long-lived animals such as horses or cattle, half a century or more.

A breeder's work is fraught with danger and frustration. What the breeder is actually doing (or trying to do) is to bend the iron laws of inheritance to suit his own ends and needs. Nature dislikes man's meddling with her organization and puts up a strong defense to keep all biological developments in precisely the

Charolais cattle appear to be destined to bring red meat within the reach of people who, until now, may only have heard of a T-bone steak.

direction and the tracks in which they have been running for aeons before. Thus, for reasons unexplained, many breeding programs, after years of experimenting, will result in utter failure.

When it comes to beef-cattle, matters get really complicated.

When the British breeds, which predominate in the U. S., were first developed, due consideration was given to local cooking conditions. Traditionally, the British cooked over an open fire—wood or coal. To prevent the meat from scorching, a large layer of fat was needed. British cooking methods were brought to the U. S.

But in France, cooking was mostly done on charcoal. The French developed their beef breeds mostly from draft-animals, thus started out with a more muscular type in the first place. For more than 300 years, French cattle were bred for leanness, which was best suited for charcoal fires, and that quality happened to turn out to be best suited, too, for cooking on gas and electric stoves.

Among the French breeds, the Charolais has now catapulted into world-wide prominence, catching the eye of cattle-experts all over the world. These huge wheat-colored animals, now numbering about 2 million in France (although only about 120,000 are "registered"), ap-

pear to be the breed destined to bring red meat within the reach of people who, until now, may have heard of a T-bone steak only by hearsay; just as 20 years ago, a broiled chicken was to them only a fairy tale.

French Charolais enthusiasts go so far as to claim that this was the breed of cattle that Julius Caesar had in mind when he reported (in his commentary "De Bello Gallico") of having encountered "some huge white cattle never seen before."

100th anniversary

In any case, the Charolais are definitely an old breed. Even their herdbook is one of the oldest: In September of this year, it celebrated its 100th anniversary. However, the present breeding program calling for complete abandonment of the working traits of these animals, and concentration on meat characteristics was started (after some unsuccessful crossbreeding experiments) as far back as 1840.

The superiority of Continental beef was recognized much earlier. Arthur Young, first secretary of the British Board of Agriculture, wrote in 1792: "... Though we have a half-dozen unequalled English dishes, roast-beef is not among them. There is no better beef in the world

than in Paris." It may very well be that the beef that Young had in mind came from a Charolais 2-year-old.

Hot cattle

In the Western Hemisphere, it was not U. S. cattlemen, otherwise always eager to try something new, who first recognized the potential of production of this breed; it was the French ranchers living in Mexico. The first group of Charolais cattle to enter the American Continent were a bull and 10 cows imported by Mexico in 1910. Larger groups followed in 1929, 1931 and 1937. From these groups originated the first Charolais brought into the U. S. Others followed just before the outbreak of World War II.

However, all animals imported into the U. S. were males, a fateful decision on the part of the importing breeders. Someone smuggled a group of 63 head of Charolais bulls and cows from Mexico into Louisiana. Of course, contraband that conspicuous is hard to hide. The U. S. Internal Revenue Department and animal health officers seized the cattle in short order and forced their return to the country of origin. (Legislation passed in the meantime and still in force today, prohibits the import of cattle from any country that is not 100 percent free of foot-and-mouth disease.)

This is the origin of Charolais cattle in the U. S. Since only males were kept in the U. S., any attempt to breed "true" has been doomed to

failure in advance. Crossbred cows were of course continuously bred back to Charolais bulls as long as the originally imported animals were alive. (The technique of deep-frozen semen and its storing was not yet known. Thus, the present American Charolais is probably at best a $3\frac{1}{3}$ rd purebred. It has, as far as the layman is concerned, all the features of the genuine Charolais. But Emile Maurice, president of the Nevers herdbook, who visited the U. S. in 1959, claims that he had no difficulty in seeing the "cutcross" in all these animals. "This one 'smells' of 'Shorthorn,'" he is reported to have pointed out while inspecting some of the outstanding American Charolais herds, "and this one of 'Hereford' and this one of 'Brahma.'")

Even so, crossbreeding available male Charolais with other breeds has had a deep-going influence on "beef-cattle thinking" in the U. S. and, as a matter of fact, has led to the creation of a new typically American breed, the Charbrais, a cross between Charolais and Brahmas, combining the tremendous mass and weight-gaining ability of the former with the resistance to tropical heat and tickborne diseases of the latter. Also the Charolais-Angus cross holds promise of a superior beef animal. This, incidentally, is the animal that Nikita Khrushchev, while visiting Iowa, called "the beef-cattle breed of the future."

What are the characteristics of the Charolais breed that have caused its meteoric rise to stardom?

Charolais bulls weigh 2,500 lbs., and cows, 1,600, with broad and thick backs, deep ribs, wide chests and enormous, full hindquarters.

Even the layman cannot help but be impressed by the colossal size of these animals—bulls weighing 2,500 lbs.; cows, 1,600 lbs.—with their broad and thick backs, deep ribs, wide chests and enormous, full hindquarters. The succulent porterhouse, T-bone and sirloin steaks almost “jump” from these animals even while alive.

Of course, what meets the eye, or the phenotype, is not the most important feature of a breeding animal.

Breeding true

To the cattle breeder, much more important is the ability to transmit the genotype (the identical genetic constitution or gene-makeup) generation after generation. Charolais seem to have this ability.

Included in this ability of transmission are precisely those features that make for a “modern” beef animal: heavy weaning weights (efficiency); rapid and economical gains *after* weaning to slaughter weight (speed and low cost of production); high carcass percentages of lean meat with a minimum of back and kidney fat (uniformity, quality and mass output).

All these features, as appreciated as they may be by cattlemen, take a back-seat, however, when it comes to cross-breeding; particularly with

the dairy cattle breeds. Crossbreeding is the mating of two animals belonging to different breeds. It produces, as a rule, a particularly healthy and strong individual (“hybrid vigor”). The country where the art of Charolais x dairy breeds crossing has been brought to perfection is Great Britain.

British cattle grass-fed

Since no large grain cereal (corn, sorghum) can be grown in Britain for climatic reasons, much cattle goes to slaughter grass-fed. There are no feedlots where cattle can be fattened by the “intensive method,” or at least there were none until very recently.

About 5 years ago, a group of livestock nutritionists headed by Dr. T. R. Preston of the Rowell Research Institute, Aberdeen, Scotland, discovered that very satisfactory lean beef animals could be produced economically by feeding male calves right after weaning (in addition to a small quantity of concentrates) nothing but the one small grain that is comparatively plentiful in Britain and cheap too: barley. As shown by experience subsequently, it was the calves from the dairy breeds so fed that turned out to have the leanest meat and the best “dressing” percentage (the ratio of usable meat to bones, fat, hides etc.)

if slaughtered at about 10/11 months of age, weighing approximately 800/900 lbs.

This so-called "barley-beef" turned out to be a boon for the British dairy farmer, particularly when the British government decided to go one step further and import a number of Charolais bulls and Charolais semen from France.

The barley-fed "baby beef" of the dairy breeds had something the beef-breeds couldn't supply: the leanness and superior dressing percentage as mentioned above. What was still needed was the rapid weight-gaining ability and economical "feed-conversion ratio" of the beef breeds.

The imported Charolais bulls bred to British dairy cows did just that. In particular, the Charolais x Ayrshire cross turned out to be a splendid young beef animal, ready for slaughter on an average 5 weeks earlier than the straight-bred animals.

Coupled with the discovery of "barley-beef," the realization of the amazing "hybrid vigor" and other features of the Charolais-dairy-breed crosses caused an upset in the British livestock industry.

Prices of new-born calves, particularly the dairy crosses, skyrocketed. Dairy farmers, not long ago unable to dispose of the "bob-calf" crop except at a pittance, found themselves all of a sudden besieged with buyers eager to raise "barley beef." Because of the increasing demand for the dairy x beef crosses, Britain experiences today a

real milk shortage; so many of the dairy animals have been bred to Charolais and other beef breeds that not enough dairy heifers are available to replace the normal cull contingent of old or blemished cows.

Not to be outdone, the Swedes, Danes, Norwegians, West-Germans etc., all have started precipitously experimenting with Charolais crosses hoping to get some relief from the present beef shortage. Northern Europe is not the only region, however, that took notice of the Charolais as the beef breed of the future. Because of their good grazing habits and placidity—the French call them "des animaux de grande douceur"—Charolais have been adopted by practically all countries of Central and South America, in particular Mexico, the Argentine, Colombia, Peru and Brazil; also by Italy, Spain, Portugal, South Africa, the USSR.

American Charolais outdated

The impact of the modern Charolais breed on America's livestock and meat industries is yet to come. All imports having been prohibited for better than a quarter of a century, all that could be accomplished with the seedstock on hand has probably been accomplished long ago. (American Charolais are outdated, say the French.)

However, quite recently, the Department of Agriculture sent a news release to all agricultural papers, to the effect that the Plum Island Animal Disease Laboratory is now in a

position to determine with absolute accuracy whether or not bull-semen imported from the continent is free of the foot-and-mouth virus (and incidentally, also of rinder-pest, a still more terrible cattle disease, widespread in Africa). This may open the door to imports of bull-semen from the Continent, much desired by breed-associations.

It will be great news to both the French and American Charolais breeders. (The French claimed for

years the restrictions were artificial, imposed only for competitive reasons.) And should the same progress in virology (as can reasonably be expected) lead at some later date to the importation of breeding stock, including females, it is not difficult to forecast a new phase in American cattle-breeding. France's Amazing Beef Machine transplanted into the world's greatest cattle country could revolutionize all existing standards and values.

Beef "fashions" are changing

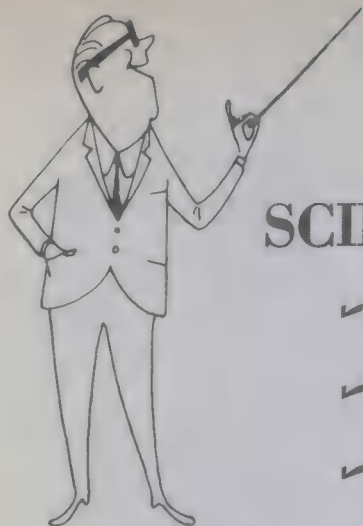
Americans are rapidly becoming the world's greatest consumers of beef ("beef" should not be confused with the statistical term "red meat" which encompasses all meats except poultry and other fowl). The world's greatest "red meat" eaters are the New-Zealanders (1963 per capita consumption 240 lbs) with the Australians second (218 lbs), the U. S. third (170 lbs). When it comes to beef and veal, the New Zealanders are still on top (111 lbs) followed however much more closely by the U. S. (100 lbs) and Australia (98 lbs). Yet, except for lowering somewhat the slaughtering age of steers, very little has been done in the U. S. to satisfy today's overwhelming demand for lean meat. And some of the troubles presently experienced by livestock-men are due precisely to that fact.

To understand what takes place in the beef cattle industry today we have to look back to the origin of our great cattle breeds.

The overwhelming majority of these cattle came from Great Britain. Only in the south-western territories originally colonized by Spain and later held by Mexico, could cattle of Spanish origin be found. (For all practical purposes they are extinguished today.)

Britain being the first country to have an industrial revolution, was also the first to allow herself the luxury of a "single purpose" animal. ("Dual purpose" cattle can be used both for dairy and meat; "single purpose" cattle give either milk or are meat animals but not both. There are hardly any "dual purpose" cattle left in the U. S.)

All our beef breeds, the Shorthorns, Herefords and Aberdeen-Angus grazing on the great cattle ranches of the West and Southwest, milling in the feed-lots of Iowa and Kansas, trace to that origin, except the Brahmas whose ancestors came—much later—from India.



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INVENTOR OF THE MONTH

How to foil a forger



Dr. Robert J. Meltzer

DR. ROBERT J. Meltzer, a physicist, has invented a device that, pending selection of a more formal name, is called The Scrambler. It is a complex arrangement of glass fibers, each about a two-thousandth of an inch thick, that transmits light.

The Scrambler enciphers and deciphers signatures, facilitates financial transactions and outwits forgers.

A savings bank, for example, can encipher a depositor's written signature and identifying information, such as the date and place of his birth. This is reproduced as a meaningless jumble on a page of the passbook, in a space one by three inches.

When the depositor presents a withdrawal slip and his passbook, the teller can place The Scrambler over the cryptogram and see the recorded signature in the clear, for comparison with that on the slip.

The Inventor of the Month is director of contract and optics research and development for Bausch & Lomb,

Inc., of Rochester, N.Y. Dr. Meltzer recently obtained Patent 3,145,247 for the company on his fiber optics cryptographic device.

The fibers are arranged in bundles at such angles that, when the signature is transmitted through them, it is as if the image had been sliced in two directions and the pieces had been pushed around. The deciphering operation puts it all together again.

The company has discussed the marketing of The Scrambler with concerns that distribute equipment to financial institutions. Besides banking, it is regarded as potentially useful in credit card and charge plate systems. Each firm could be assigned a distinct pattern, or could use several for different sections of the alphabet.

Dr. Meltzer has written many technical papers on spectroscopy and spectrophotometry. He holds half a dozen patents on instruments, and has one pending on an optical catheter.

—*Stacy V. Jones*

INVENTIONS PATENTS PROCESSES

Guns that shoot down fruit



Pneumatically-powered fruit-picker increases speed of harvesting 3 to 4 times.

FARMERS may soon be shooting down fruit with guns.

A pneumatically-powered soft-fruit picking machine, which is reported to increase the speed of berry harvesting three to four times, has been developed by Rentokil Laboratories Ltd., Smarden, Kent, England. The picking gun is fed compressed air via an overhead boom, from a compressor mounted on a tractor. The gun blows the fruit off the branches into plastic hoppers. Each polyethylene hopper holds 25 pounds of fruit.

The manufacturer says that the fruit is harvested in a clean, whole-

some condition, and at a lower cost than by hand picking. Four or eight rows of bushes can be harvested at a time. Fruit handling is minimal because the hoppers slide under the bushes, where they receive the fruit dislodged by the air guns.

The hoppers can be stored out of doors, are resistant to the corrosive effects of fruit juices and can be washed with boiling water.

New breathing machine

A liquid-oxygen breathing apparatus for work in toxic atmospheres, such as rescue work in mines, has been developed by Siebe Gorman & Co., Ltd., Chessington, Surrey, England. The apparatus is said to be light, compact, comfortable and easy to maintain. It helps to dissipate the wearer's body heat, instead of increasing it.



Mine rescue worker tests new liquid oxygen breathing apparatus developed in England.

The three main assemblies—an expired gas purifier, a liquid oxygen evaporator and a breathing bag—are contained in a back pack of molded glass fiber. Breathing tubes extend from the back pack to a valved mouthpiece.

The apparatus is ready for use after being charged with liquid oxygen and CO₂ absorbent. The wearer breathes cool, dry oxygen, and his expiration is purified by passing through the absorbent. The recovered oxygen is cooled and dried by the evaporator before entering the breathing bag, where it is mixed with cold oxygen. The oxygen supply lasts about 2½ hours.

Floating radio

A small portable radio transmitter/receiver for use in ships' lifeboats has been developed by the International Marine Radio Company Limited, a subsidiary of International Telephone and Telegraph Corporation.

The survival radio, called SOLAS II, is completely transistorized and weighs less than 30 pounds. It transmits and receives on three different frequencies, and can be operated by one man.

One of the most attractive features of SOLAS II is that it floats. If it falls or is thrown overboard in an emergency, it can be retrieved in operating order. The set has been built to withstand a 30-ft. drop into the water, and has a 30-ft. nylon heaving line attached. When in use, the set can be strapped to the op-



Lifeboat radio straps to the operator's body, permitting hand-free operation.

erator, leaving both hands free to operate the equipment.

An 18-ft. whip antenna, headphones and microphones are stored in the fiberglass case of the set.

Cow got a stomach ache?

A device has been developed by Westinghouse Electric Corporation for cows suffering from hardware disease, bovine traumatic gastrocitis.

Many cows contract this serious stomach disorder from swallowing bottle caps, nails, pieces of barbed wire and other objects frequently found in pastures. Hardware disease can cause sour milk in dairy cows and loss of weight in beef cattle.

The Westinghouse device is a small magnet fed to the animal, which finds its way to the cow's paunch. The metal objects gravitate toward the magnet, and are

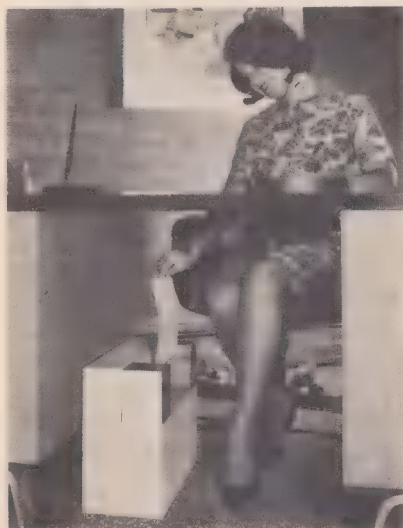
thereby prevented from passing into the digestive system. After the magnet becomes covered with metal objects, it can be removed by minor surgery.

Hungry wastebasket

Have you ever rumaged through a wastebasket for that valuable scrap of paper you inadvertently threw out? If so, consider carefully before purchasing the Destroyit electric wastebasket, which automatically shreds your papers into unreadable waste.

It can be of use to those who want to protect their obsolete but important papers from snoopers.

Any paper inserted into the opening of the electric wastebasket is automatically shredded into $\frac{1}{8}$ inch strips. The shredding process takes



Electric wastebasket automatically shreds your papers into unreadable waste.

only a few seconds.

The electric wastebasket is no bigger than the average wastebasket, and plugs into any outlet. Further information is available from Michael Lith Sales Corporation, 145 W. 45th St., New York, New York 10036.

Ultraviolet flashlight

A new lightweight ultraviolet flashlight, which can throw a beam up to 45 feet, has been announced by Med Electronics, Inc., United Instrument Laboratories Division, 102 W. Jefferson St., Falls Church, Va.

The ultraviolet flashlight looks like a standard flashlight. It operates on three standard D size flashlight batteries. The batteries have a minimum life of two hours in intermittent service. The flashlight is available in kits for industrial, biological and security uses.

The flashlight is designed for such purposes as detection of fluorescent checking dyes, biological and mineral studies, and special inspection uses in defense, aerospace and private security systems.

Fluorescent lamp grinder

Want to get rid of a lot of old fluorescent lamps?

A machine that grinds them into small pieces under water may be obtained from the Laduby Co., Inc., P.O. Box 88, Branford, Connecticut. The disposal units are available in portable or permanent models.

Cocoon for learning

Among the exhibits of the "brave new world" of education recently put on display in the Hall of Education at the New York World's Fair was the "Studysphere," the startling piece of equipment shown above. (Many Fair-goers missed the Hall of Education because it opened late in the 1964 season. However, it will be open throughout the 1965 Fair season.)

An opaque spheroid six feet in diameter, the "Studysphere" is a home-study unit for students of the 21st Century. A controlled ionized atmosphere will contribute to the student's sense of well-being, supposedly encouraging the learning process.

Conveniences include controls for temperature and light, as well as ionized air, and an adjustable seat. TV and film screen, microphone,



21st century education will take place in the "Studysphere," a home study unit.

tape recorder, stereo speakers and a built-in computer are provided. The sphere is also equipped with an antenna for reception of audio and visual signals from all over the world, including signals "bounced" off the moon.

The "Studysphere," a sort of cocoon for learning, will be completely mobile and usable anywhere in the home by plugging the power cord into electric sockets. Youngsters, and their parents, will use it.

The material for this education in the home will emanate from a giant complex called a Regional Center, one of many located throughout the world. Each center will also have facilities for students—individuals and family groups—who convene there for educational and cultural activities that cannot be conducted in the home.

YOUR SCIENCE ABC's

Photography

FIXING THE WORLD ON PAPER

PHOTOGRAPHY is the art of "fixing" on paper or any other convenient material the image produced by a convex lens. If you hold a magnifying glass an inch or two away from the wall of a room, opposite the window, you will see a small picture of the window on the wall. It will be upside down, but still—it is a picture. The idea of fixing it first occurred to Thomas Wedgwood, son of the famous potter, and his idea was to make use of a discovery by the chemist Schultze, who found that light blackens certain salts of silver. With Sir Humphry Davy, Wedgwood made experiments with paper soaked in solutions of silver chloride and silver

bromide, and in 1802 succeeded in making the first black and white prints. Unfortunately, they soon became black all over, owing to the light in the room.

A way to stop this from happening was not discovered until 1835, when W. H. F. Talbot found he could "fix" the prints with ordinary salt. In France, Joseph Niepce made a successful photograph about 1822.

A great drawback in pictures made in this way is that all the bright parts, where the light is strongest, come out dark, and all the dark parts remain white. Such a picture is called a "negative," and Talbot discovered that if he made a negative on very thin, transparent paper, he could afterwards use it to make a "positive" print on another piece of paper, on which the black parts of the negative were restored

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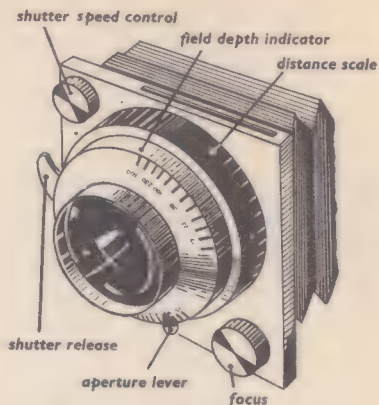
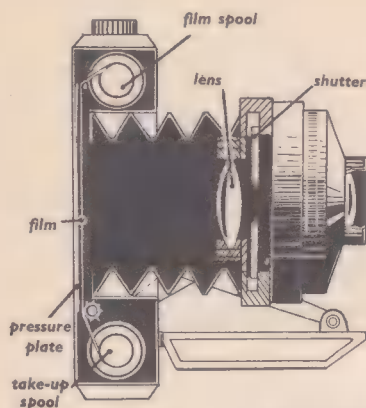


Diagram of a simple camera in cross section (left) and front view (right).

to white, and the white parts to black.

Talbot then made another valuable discovery. The blackening of silver salts is a very slow process and the results are smudgy and far from perfect. Talbot found that if only a short exposure to the light is made, though the silver is not blackened immediately it can be blackened or "developed" afterwards by means of a chemical that precipitates all the silver in the salts previously exposed to the light. This gave a sharper and clearer negative.

Daguerre's discovery

While Talbot was developing his pictures, a Frenchman, Louis Daguerre, found a way of taking photographs on a metal plate. These also were negatives, but he was able to change them to positives by exposing them to mercury vapor. They were called "daguerreotypes," but they only produced the one copy of

each picture, whereas Talbot was able to print any number of copies of his "talvotypes" from the same negatives.

Then Sir John Herschel, the astronomer, discovered a better way of fixing Talbot's negatives with "hypo" instead of salt, and invented the words "photograph" and "photography." But photographs printed from paper negatives were still imperfect. A significant advance was made in 1851 when it was discovered how to deposit a layer of sensitive silver salts on a glass plate by coating it with a film of collodion. Negatives made on glass plates gave perfectly clear prints. The step that made photography an everyday activity, the introduction of the celluloid negative and roll film, was taken primarily by George Eastman in the 1880's. Roll film also made possible the motion picture. Today, film is generally made of cellulose acetate, a much less flammable material than celluloid.

In modern photography, extremely sensitive materials are used, and with specially designed lenses, snapshots can be taken in a tiny fraction of a second. To make this possible cameras had to be devised that would work with the precision of a watch. A modern camera is a light-tight box with an arrangement for stretching a film over the inside of the back. In front there is a lens, but light is prevented from entering by means of a "shutter." This is a kind of sliding door that can be opened and shut with great speed by means of a spring, which is operated from outside the camera. The camera also has a "finder," which

enables the photographer to tell exactly what pictures will be taken when the shutter is opened.

Today, there are several ways of taking photographs in color, and they all depend on the fact that all colors are mixtures of the three primary colors. If three pictures, each taken through a separate colored glass, are brought together on the same negative, colored dyes in the negative can be made to come out in the correct proportions and so give a correctly colored picture. The details of color photography are too complex to explain in a short space, but anybody nowadays can take color photographs.

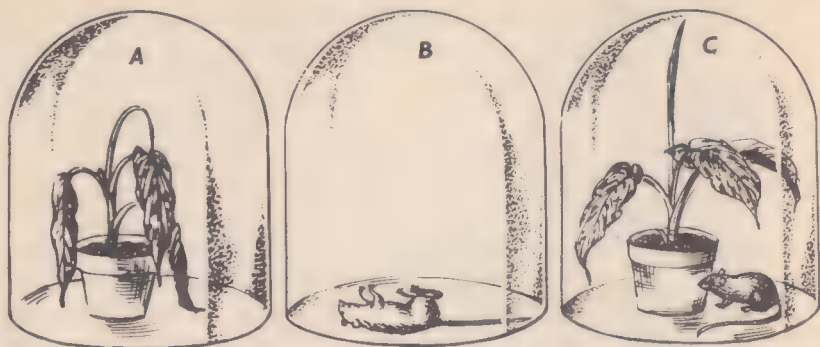
Photosynthesis

WHY GREEN PLANTS ARE GREEN

If it were not for green plants, neither man nor any other member of the animal kingdom could exist. The reason is that all life on earth depends on energy from the sun coming to the earth in the form of sunlight. Only green plants can capture energy from sunlight and store it as food. Plants do this by a process called photosynthesis, in which carbon dioxide from the atmosphere and water from the soil are converted into a sugar called glucose. The plant then converts the glucose into starch and many other substances. When animals eat green

plants, they obtain the plant's sugar, starch, and so on, and "burn" it to obtain the energy for growing, building tissue and moving about. Animals that eat other animals (our eating a steak, for instance) are simply eating animals that converted sugar and starch from plants into meat.

Green plants make use of a green substance named chlorophyll to capture energy from sunlight and accomplish the feat of turning carbon dioxide and water into sugar. This substance is why green plants are green, and why only green plants



In a historic experiment, Joseph Priestley showed that plants need carbon dioxide and give off oxygen in photosynthesis. Plant in jar (A) dies for lack of carbon dioxide. Mouse in (B) dies for lack of oxygen. But both thrive together in (C).

are able to perform photosynthesis.

In the past several years, chemists have learned a great deal about just how photosynthesis is carried out. For instance, plants use only certain wave lengths of light for photosynthesis. Also, plants in bright light can produce more sugar and starch than plants in dim light, but only up to a certain limit; beyond that, making the light brighter will not make plants produce sugar and starch faster. In other words, plants can work only so fast.


A remarkable feature of photosynthesis is that free oxygen is a

by-product. Thus during daylight hours, green plants give off oxygen, and can help freshen the air in a house. More important, we owe the oxygen in the atmosphere to green plants. Many scientists believe that the earth's atmosphere once contained little or no oxygen and that it was the green plants that changed things about. In any event, if there were no green plants, all the oxygen in the air would have been used up long ago. Thus, animals owe not only the food they eat, but the oxygen they breathe, to green plants and the process of photosynthesis.



How to tell if a musk ox loves you

WHEN threatened by wolves, their principal enemy, musk oxen form a circle, with the calves in the center. By lowering their shaggy heads, the adults present an unbroken front of sharp horns. Teams of bulls then make short charges at the wolves. John J. Teal, Jr., who is helping the University of Alaska raise these wild Arctic cattle, recalls an evening when he was in the pen with his musk oxen. A large dog approached the fence. The snorting, stamping oxen immediately formed a defense perimeter with the naturalist in the center. He knew then that he had been accepted.



the progress of **MEDICINE**

How to stretch a leg

by Arthur J. Snider

EACH day an orthopedic surgeon gave one full turn to a pair of adjustment screws on the steel frame to which the left leg of 13-year-old Patrick A. McKillen was pinned. Each turn stretched Pat's leg one-sixteenth of an inch. Nature is doing the rest. It will fill in the widening gap with healthy bone tissue and eventually the boy's legs will be the same length.

A polio attack two years ago left Pat with his left leg two inches shorter than the other. He was brought to the University of Michigan Hospital, where surgeons, instead of shortening the longer leg, as is sometimes done, decided to lengthen the shorter one.

Bolts were placed through the upper and lower portions of the leg bone and the bone cut between them. Theoretically, if a child's leg is stretched a tiny bit each day, new bone will grow to fill the gap.

This is working out in Pat's case, the first in which such an operation

has been performed in this country.

One day, Pat should be able to discard his leg brace, elevated shoes and crutches and run for himself in a baseball game instead of yielding to a substitute.



Pat says there was little pain during the stretching operations but that sometimes the skin over the leg "felt tight."

Long before Pat was born, doctors had been seeking ways to correct discrepancies in leg length.

In 1920, a method was developed for cutting the bone of the short

leg and stretching it to the desired length. But infection, and excessive strain on tendons, nerves and blood vessels caused abandonment by American doctors. It became the custom in American surgery to arrest growth of the long leg until the short leg caught up.

But before the stretching technique was scrapped, it came to the attention of a Scottish surgeon, who refined the operation. A University of Michigan surgeon, Dr. John T. Hayes, saw the operation performed on a visit to Edinburgh and brought back the new technique.

Who needs exercise? (cont'd)

On the subject of exercise to keep physically fit, Dr. Frank P. Foster of the Lahey Clinic, Boston, asks: "Who needs it?"

Dr. Frank E. Barnes, Jr., chairman of the school health committee, North Carolina Medical Society, replies: "Children."

The two physicians have debated the issue of exercise in "The New Physician," a publication of the Student American Medical Association.

"Athletic and physical fitness programs today are in danger of becoming a patriotic enigma wrapped in tradition, misinformation, foggy thinking and old wives' tales," says Dr. Foster, offering arguments summarized in *Science Digest*, July, 1964.

In reply, Dr. Barnes declares the United States is "filled with weak and nervous people; over 50 per-

cent of our draftees are being turned down as physically or mentally unfit; colleges have found a decline in the physical fitness of entering freshmen."



"With the car, automation, modern household conveniences, longer leisure periods and TV, we don't even get the exercise our jobs once gave us," Dr. Barnes adds. "No one knows how to walk today; a child starts using a car at the age of 16, and before this, mother drives him all over the neighborhood so he won't wear himself out. It is difficult these days to get a husky boy out for a sport. The car and local candy store are more fun than practicing football."

A third participant in the debate, Dr. W. W. Bauer, director-emeritus of the American Medical Association's health education department, disagrees with both physicians.

It is wrong for Dr. Foster, he says, to charge advocates of fitness with claiming that fitness and health are interchangeable. And it is a mistake for Dr. Barnes to introduce Selective Service statistics

as a measure of the nation's health or physical fitness.

"Even the Selective Service office has at last admitted that these are measures of military availability rather than of health or fitness in the ordinary sense of the term," Dr. Bauer points out. "At the moment, the heavyweight champion of the world (Cassius Clay) is physically unfit for military service as are a number of other star athletes."

"It pays to be a patient"

Some people are buying so much hospital insurance, they are finding it pays to be a patient. Because of employment of husband and wife, a number of families have double coverage. In addition, they buy other policies that advertise pay-off regardless of what other coverage is held. Added to these are policies covering camping, hunting, school bus transportation, playground insurance for children and others.

The profit in being in a hospital for the multiply-insured family can be significant, according to Thomas C. Paton, executive vice president of Minnesota Blue Shield.

"When you consider that the average hospital day costs \$40 to \$50 and you multiply that by 20 to 30 days, you have a sizeable figure," he points out.

There is no law to prohibit a person from carrying more than one policy or from collecting more insurance than his expenses amounted to. Insurance companies say it is difficult to uncover instances of mul-

tiply coverage. Even when such cases are discovered, it is difficult to prove fraud and deception.

With the rising cost of medical care, some persons take out an additional policy to assure full coverage in the event of major expenses.

Hospital committees designated to monitor "over-utilization" of hospital services—a factor in raising the cost of medical care—have a difficult time "with this kind of patient because his compelling motivation will be to get what he has paid for or to profit from his investment," Paton points out.



No one knows the number of "over-insured" Americans, for there is no clearing house, but insurance companies say their private investigations have convinced them it is large. One company checked records of a hospital in the South and found that among 3,000 patients, 140 collected on four or more policies. Some had as many as 25 and one had 32 policies.

Some elements of the industry are to blame through their high-powered advertising and promotion

campaigns, Paton contends, adding: "The average American gets four promotion pieces a month bewitching him into buying some new twist in health insurance."

If one company brings out a policy that restricts payment in some way, another company will use that restriction as a sales argument.

Their customers are usually families expecting to be using the hospital soon and frequently.

Another factor is the unplanned character of new hospital construction in some parts of the country. This leads to an oversupply of beds and the tendency of hospitals to try to fill them.

"Doctors just aren't going to send many patients home early from a hospital that is half-empty," Paton says.

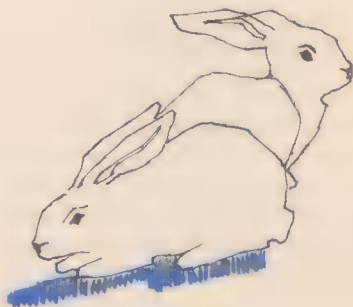
Calcium and atherosclerosis

The body needs calcium in order for the heart to beat, muscles to contract, blood to clot and bone to harden.

It keeps a certain level of calcium on tap in the blood at all times. When the level drops too low, the body calls on the warehouse—the bone m a r r o w—where more than 99 percent of the supply is stored. When the blood has an excess, calcium is put on deposit.

This continual transport, a feed-back system rivaling the most complicated automation equipment, is under control of the parathyroid glands, four pea-sized bodies behind the thyroid gland.

It has been believed that keeping calcium (and phosphorus) in equilibrium was the parathyroids' only role. But a University of Chicago team of investigators has found the parathyroids appear also to play a part in handling of body fat. They may, therefore, be playing a key but hitherto unsuspected role in hardening of the arteries (atherosclerosis).



Dr. Edward Paloyan and his associates were studying atherosclerosis in rabbits and inducing the disease by the standard method of feeding the animals a diet high in cholesterol. To their surprise, enlargement of the parathyroids developed in 14 of the 15 test rabbits.

When that finding is tied to previous known facts, it is possible to theorize that an excess deposit of calcium in the blood vessels is a factor in atherosclerosis.

It is known, for example, that rabbits given a high cholesterol diet for several months will develop thinning of the bone with frequent fractures. It also is known that fats in the blood can be increased by

giving animals parathyroid hormone.

To Dr. Paloyan it adds up to a clue, but he cannot say yet whether the role of the parathyroids is good or bad. "There is not sufficient data to determine whether they contribute significantly to the development of experimental atherosclerosis," he asserts, "or whether they exert some protective or retarding influence."

You can push teeth around

Most people think the tooth is fixed in the jaw bone structure. It isn't, says Dr. Arnold E. Stoller, a Seattle orthodontist. It is held in position by cellular tissue just above the bones. Thus, it takes only slight pressure, applied from time to time, to cause the teeth to shift into irregular position.

The model for Rodin's sculpture, "The Thinker," may have ended up with tooth malformations if he kept his chin on his hand for long periods, Dr. Stoller says. Pressures resulting from leaning on the chin while studying or holding up the chin while watching television from the floor are enough to move the teeth without pain or discomfort.

Dentistry has taken a lesson from these pressure patterns. "If these forces will make a dramatic change without discomfort, why not reverse the procedure and use a similar amount of force to straighten the teeth?" Dr. Stoller asks. "With proper application, teeth can be moved with as little pressure as one to two ounces of force."

Dentist checks children's throats

All imaginative medical advances don't originate in large medical centers. In the Chicago suburb of Stickney, a dentist has developed a procedure that may contribute much to the prevention of rheumatic fever, the leading cause of childhood heart disease.

It is the aim of Dr. Gene J. Franchi to make every dentist's office a front line against rheumatic fever by noting if the throat of the child in the dental chair is inflamed or sore or if the tonsil area has exudate. If so, a throat culture is taken with a quick swab and within 24 hours, the germ is identified, if present.

If the culprit is a breed of bacteria known as group A beta hemolytic streptococcus, the child is referred to the family physician for medical evaluation and drug treatment. This particular "strep" germ causes about 40 percent of throat infections. From 0.3 percent to 3 percent of strep infections are followed by rheumatic fever. Almost half the cases of rheumatic fever affect the heart.

"It occurred to us that a child with strep infection might keep a dental appointment even though not sick enough to require a physician," said Dr. Franchi, who doubles as Stickney's health officer.

Dr. Franchi estimates the nation's 100,000 dentists see at least 6,000,000 children annually between the rheumatic fever ages of 5 and 15.

It's not always in your head

Physicians today are more aware of the psychiatric problems of their patients. Dr. Phillip L. Rossman of St. John's Hospital, Santa Monica, Calif., feels that sometimes physicians diagnose a professed ailment as an imaginary symptom stemming from mental disorder when it is actually caused by a very real organic disease.

Dr. Rossman studied 115 patients, all of whom had been diagnosed as neurotic, psychoneurotic, hysterical or having other mental problems. All were eventually found to have organic diseases. After correct diagnosis was established, 45 were cured, 36 improved, three remained about the same and 31 died. All of the patients initially were advised to see a psychiatrist, and 66 percent did so. Psychotherapy lasted from two days to 25 years.

Eight persons who were given electroshock treatment turned out to have such conditions as hyperthyroidism, chronic pelvic inflammation and tumors of the nervous system.

Dr. Rossman lists "lack of physical or laboratory abnormalities" as "probably the most important factor" in mis-diagnosis, and implies that overdependence on laboratory tests is at fault.

"The modern-day scientific approach to medicine makes the physician feel more secure in his diagnosis if he has laboratory support," he states. "In many cases, authen-

tic symptoms were disregarded because this conformation was lacking. For example, the headaches of brain tumors were disregarded because there was no neurologic defect. The backache or abdominal pain of early malignant disease was termed neurotic when the first X-rays showed no lesions."

Dr. Rossman concludes, "that if symptoms are uncorroborated by a physical examination, laboratory tests or an x-ray examination in anxious, worried, over-complaining or persistent patients who have marital, sexual, financial, family or other troubles, there is a tendency to label them psychoneurotic."

What kills a cancer cell?

Stuff a cancer cell with oxygen and it dies more quickly under x-ray bombardment.

Medical scientists are trying to exploit this well-known fact of cancer life through the use of the hyperbaric oxygen chamber, the super-saturating device that forces gas into the tissues.

Dr. Orliss Wildermuth of the Swedish Hospital, Seattle, has used it on 100 patients, most of them in the incurable class. While he achieved few, if any, cures, there was a reduction in pain and a sparing of the patient's healthy tissue.

In 11 patients with cancer of the esophagus, a difficult cancer to treat, recovery of the ability to swallow and to eat normally was noted. Also treated were cancers of the pancreas, mouth and lymph nodes.



Carl High

In 1961, the "Weather Reporter" recorded a wave 67 feet from crest to trough.

The highest waves ever seen

by L. Draper

STORIES abound of monstrous waves; every sailor has his tale of how a great wave arose from nowhere and hit his ship leaving a trail of damaged lifeboats and shattered crockery.

Estimates of the heights of the highest waves which can be encountered at sea vary widely. Cor-

nish reported a freak wave 70 feet from crest to trough seen in the North Pacific in 1921, and waves of 80 feet and possibly higher in the North Atlantic in 1923. More recently, in 1956, Captain Grant of the cargo vessel *Junior* reported a wave estimated to be 100 feet high about 100 miles off Cape Hatteras. There must be many more reports of similar waves in the history of the seas. As early as 1826 Captain Dumont d'Urville, a French scientist and naval officer in command of an expedition, reported encounter-

Reprinted with permission from *Oceanus*, published by the Woods Hole Oceanographic Institution, Woods Hole, Mass.

The big waves last only a minute or two, but they can reach towering heights. The highest reliably reported was estimated at 112 feet.

ing waves 80 to 100 feet high. The poor fellow was openly ridiculed for making such an outrageous report, even though three of his colleagues supported his estimate. Perhaps the most famous reliable report was that of the wave encountered by U.S.S. *Ramapo* in the North Pacific in 1933; that wave was estimated to be 112 feet high, a monster indeed.

Waves traveling together

There are two aspects of this problem. One concerns what happens on a sea when a large number of wave components each with its own period and height, are traveling along together at slightly different, but constant, speeds. As the components continually get into and out of step with each other they produce the groups of high waves followed by brief intervals of relatively quiet water which are characteristic of all sea waves. Every now and then, just by chance a large number of these components get into step at the same place and an exceptionally high wave results.

The life of such a wave is only a transient one, being not much more than a minute or two. Because each

wave component is traveling at its own characteristic speed, the faster ones will escape from the others and the monster wave will die.

The energy it contains belongs to its component wave trains, which still exist and travel on, taking their energy with them. Somewhere else in the storm at some other time some other wave trains will, again just by chance, coincide and produce another large wave which will have its brief moment of glory before disappearing forever into the random jumble of the sea.

It is only about thirteen years since it became possible to measure waves in the open sea from a ship with acceptable accuracy, and so provide a check on whether or not the stories of monstrous waves were to be believed. One of the British Ocean Weather Ships, operating in all weathers in the North Atlantic, has carried such a shipborne wave recorder for twelve years. As the ship is on station for about two-thirds of the time, the National Institute of Oceanography now has a long series of wave records which were taken for fifteen minutes every three hours.

At first the scale of the instrument could record waves 50 feet high from crest to trough, but very soon it was found that waves higher than this were not uncommon and the scale was increased to 60 feet.

L. Draper is a physicist who, since 1953, has worked mainly on ocean waves at the National Institute of Oceanography in Great Britain.

This proved to be adequate for about nine years, but on September 12, 1961, *Weather Reporter* lay close to the track of the dying hurricane Betsy, and as she made her routine recording at 0900 hours the pen dipped and touched the lower edge of the chart and then rose rapidly and "hit the stops" at the top—a wave over 60 feet high. A crest was fitted to this wave and it is estimated that the true height of the wave was not less than 67 feet from crest to trough. The period of this wave was 15 seconds, which meant that the weather ship was lifted over 60 feet in $7\frac{1}{2}$ seconds and then dropped almost as far in the succeeding $7\frac{1}{2}$ seconds! The probability that we actually recorded the highest wave which hit the vessel is fairly small, because the instrument is operated for only about 8 percent of the time.

At the present time the wave which *Weather Reporter* measured is the highest one which has ever been recorded by an instrument—conservatively estimated to be at

least 67 feet from crest to trough.

Because the proportional area of an ocean which is occupied by vessels is incredibly small, it follows that only a minute proportion of the exceptional waves which must occur each year in an area such as the North Atlantic are ever noticed by man. It therefore seems reasonable to suppose that with only one vessel equipped with a wave recorder regularly at sea in the North Atlantic, the chance that our 67 foot wave is the highest which ever occurred is small indeed. We must by no means claim that the report from the *Ramapo* was exaggerated.

Established physical laws

Although one is inevitably surprised when an exceptional wave appears to rise from an apparently ordinary rough sea, and everyone who sees or feels it labels it as a freak, it is fair to say that no miracle is being witnessed; the chance of this occurring does seem to obey well established physical laws.



Everglade kites almost extinct

Less than twenty of the Everglade kites survive in the United States, according to the Interior Department's Bureau of Sports Fisheries and Wildlife. The dark grey, hawk-like birds face extinction because extensive swamp drainage is destroying their natural habitat and source of food. The kites feed exclusively on a single species of fresh-water snail, which is found only in the shallows of permanent, fresh-water marshes. As man takes land and water for his needs, the marshes dry up, the snails die and the kites disappear. Ornithologists say that the only hope for the kite is to restore and maintain adequate water areas where the snails can flourish and the birds can find ample marsh vegetation for nesting.

The proposed World Science Center (right) will be located near the burgeoning Lincoln Center for the Performing Arts on Manhattan's West Side. The Hall of Science (opposite page) will ultimately have a 26-acre site in Flushing Meadow Park. It is expected to cost \$7.1 million.

Science in New York

NEW YORK City is making a bid to become the world's science capital.

Two buildings, one partially open, the other scheduled for opening in 1967, will give the city a strong claim on the title.

The Hall of Science, which opened in September on the New York World's Fair grounds, will not be torn down with the rest of the exhibits, when the Fair closes at the end of its 1965 season. It is hoped that the hall will be the nucleus of a permanent science museum which will transmit the ideas of science to the layman.

A complementary function will be

served by the 21-story World Science Center, which is being planned by the New York Academy of Sciences.

The \$25 million building will have facilities for lectures, motion pictures, demonstrations and meetings. To some extent, these may be open to the public, but the main purpose of the Center will be to aid scientists in getting their ideas across to one another.

Flushing Meadow's Hall of Science is unquestionably the more spectacular looking of the two buildings. It is a vaulting space wrapped in an undulating wall pierced with chunks of glass.

From the inside, this unique con-





struction gives the feeling of the limitless expanses of space.

Eventually, several other buildings and a space garden are planned for the area around the hall. But at present, the only major exhibit is a film, *Rendezvous in Space*, and animated models of space vehicles that perform their simulated exercise 80 feet above the main floor of the hall. The film was donated by Martin Marietta Corp.

Fair officials hope the hall will provide a resting place for some of the worthier science shows from other pavilions after the Fair finally closes its doors.

Although the New York Acad-

emy's proposed World Science Center looks like an ordinary office building, and, indeed, will contain the offices of the Academy and other scientific organizations and science-oriented business corporations, in addition it will have some special features.

Among them will be a library and data center that would coordinate information on developments in all disciplines for dissemination to its 18,000 member scientists and to universities and businesses.

And for the benefit of laymen, the center is expected to serve as the source of scientific educational television broadcasts.



BIRD TRAP

An ornithologist (above) carefully and quickly extricates a trapped bird to avoid injury to wings and feet. The bird will then be examined for disease-bearing ticks.

In some areas (right), nets have to be set up in deep swamps, a difficult and dangerous task for Dr. Salim Ali and his team of ornithologists and medical researchers.

Before the bird trap, a mysterious fever swept Northern India each spring. Several months later, the same illness scourged central Russia.

IN THE SPRING of 1957, the World Health Organization at Geneva, Switzerland, began receiving reports of the outbreak of a sudden and mysterious fever in the Kyasanau district of India's state of Mysore. Hundreds had been stricken with the fever, accompanied by headaches, nausea and diarrhea. Most of the victims were men, who in many cases also complained of inflammation of the eyes. Debilitation was rapid and 10 percent of the patients died a few weeks after contracting the first symptoms.

Several months later, the same mysterious illness swept Central Russia. Medical authorities were unable to account for any connection between the two outbreaks or their cause.

In Bombay, specialists at the Medical Research Institute examined humans and monkeys who had died from the disease, and discovered that it was caused by a virus found in a species of tick known as *hemaphysilis spinigera*. The specialists were at a loss to explain how this disease, hitherto unknown, had



All photos Threv Lions.





After passing inspection and being "de-ticked" if necessary, each bird is tagged with a tiny metal ring before being permitted to proceed on its northward flight. The operation is repeated every year in Northern India by Dr. Ali and his humanitarian team.

Even wild ducks are inspected (below left) to determine if they are carrying the deadly tick. The ticks (below right) attach themselves to humans and animals alike and were responsible for the death of thousands in southern India, in February, 1959.



If the ticks are present, they are found on the bird's head near the eyes. The birds are immune to the tick-borne disease.





Thousands of birds fill the skies of Northern India each spring. Dr. Ali and his assistants must try to capture, examine and then release them.

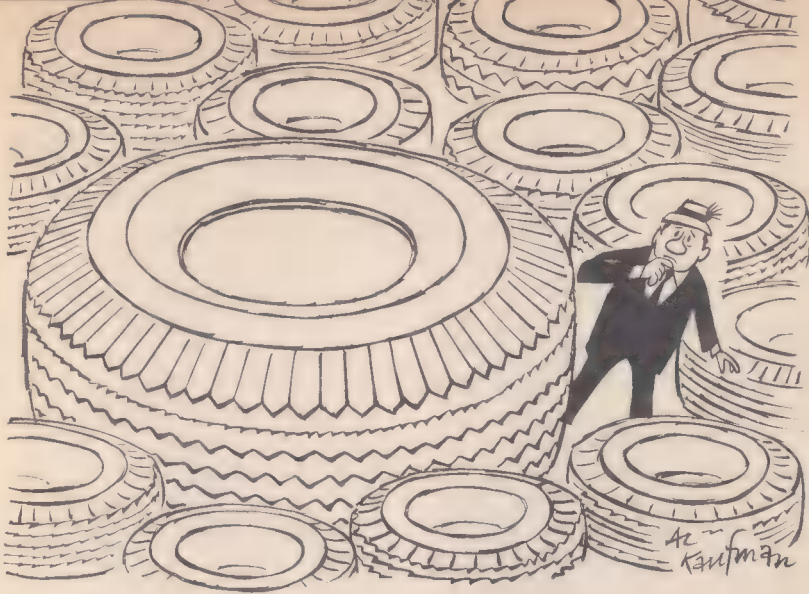
come to appear almost simultaneously in two regions thousands of miles apart.

The head of the Tick Division of the Research Institute happened to discuss the problem with an old friend, Dr. Salim Ali, India's outstanding ornithologist and vice-president of Bombay's Natural History Society. Dr. Ali conjectured that the ticks had been carried to these remote regions by birds travelling across the skies of India each spring.

In the spring of 1959, Dr. Ali and a team of medical research men and ornithologists went to the Kutch Desert, a region in Northern

India where birds habitually stop on their spring flight from southern India to Russia. Nets of hair-thin thread were set up to capture the birds, so that they might be examined for the disease-carrying ticks. Dr. Ali's suspicions were correct; the birds were infested with the deadly insects which brought the fever to India each spring. After being "deticked" and tagged, the birds continued their flight to the North.

Each year, this operation is repeated, enabling international health authorities to warn and take measures against the bird-borne tick fever.



The truth about tires

Stronger, safer tires for your car are available today—but you must know how to pick them. If you get lost in the jungle of fancy names and guarantees, you may be risking your neck.

by Bruce H. Frisch

TIRES TODAY are genuinely better than ever, but the average person may have become so confused by a market gone wild that he is buying tires inferior to ones he had years ago.

Two of the country's motor-minded legislators are out to bring this runaway market under control before someone gets killed.

Five major companies—Firestone, Goodyear, Goodrich, U. S. Rubber and General—dominate the market. They make five grades of tires as recognized by the Federal Trade Commission.

Premium tires at a premium price often have puncture-proof or blow-out-proof construction.

The next lower grade is called the 110 level to show that it is slightly better than the standard 100-level. Many smaller companies don't make this grade. Often the 110-level tire is basically the 100-level tire in nylon rather than rayon.

Tire Guide, an annual for guiding the trade through the tire jungle, ignores this level altogether. It proceeds directly to the 100-level or first-line grade of tire which comes as original equipment on a new car.

Second- and third-line grades of weaker construction follow.

From 1958 until 1963, tire prices dropped 17 percent. If the car owner couldn't tell what he was getting, at least he was getting it cheap.

The five grades form only the loosest and most elusive framework. At the front of its listings, *Tire Guide* warns, "Users of these charts can assume that tires listed as premium cost more than first line, first line more than second line, etc. But they should not assume that all premium tires cost the same or are equal in quality or that first, second or third line match each other in quality, although they are similarly priced. It is possible that in some cases first line nylon constructions are listed as premium."

In any event, dealers are likely to omit grades from their advertisements, leaving you to wonder if Ambassador is better than Celebrity or Safti-Flight. (No, they are in reverse order. Next year, their relative quality may have completely changed, because names are constantly down-graded.)

Discount house chaos

Confusion has always marked the tire market, but it turned to complete chaos when discount houses and department stores started bringing out their own private brands. Retail list prices became meaningless. The number of brands shot up. One source says there are "over 100"; another source says "over 115"; *Tire Guide* cuts its list off at about 60.

The number of manufacturers is still not large. The big five began supplying the private brands themselves in direct competition with their own dealers. To keep their dealers in the fight, the tire companies had to discount their wholesale list prices. At the same time, they vainly tried to recoup by tacking fictitious rises on the fictitious lists.

Guarantees meaningless

They hoped to shift competition to quality and guarantees. Guarantees, however, were meaningless. When a customer returns a bad tire, the dealer gives him a credit toward a new tire in proportion to the tread left. Too often, the dealer charges list price for the replacement and the customer ends up paying as much as he would if he had bought at discount without a guarantee. The trick is so well-known that some dealers advertise that they pro-rate guarantees on the original sale price.

From 1958 until 1963, tire prices dropped 17 percent. If the car owner couldn't tell what he was getting, at least he was getting it cheap. It looked like the consumer had come out ahead.

One man wasn't so sure. That was New York State Senator Edward J. Speno. Cut-throat price

competition raised sales of the third-line "cheapies." They are skinnier, have fewer and lighter cords and less rubber on the tread and sidewall than original-equipment tires. Manufacturers say they are good enough for around town but not for high speed or sustained freeway driving. But, does the purchaser always know the tires' limitations or follow them?

Speno opened his attack early this year by introducing what would have been the first law in this country setting safety standards for tires.

A law resulting from a Speno crusade against "baldies" (tread-worn tires) the year before had just gone into effect, encouraging him in his new fight. That law had also been the first of its kind in the United States. The issues it raised supply some background on what makes a safe tire.

The law prohibited tires with less than $\frac{1}{16}$ in. of rubber between the top of the tread and the bottom of the grooves as well as tires with various kinds of cuts, bulges and other defects. A new first-line tire usually has between $\frac{5}{16}$ and $1\frac{1}{2}$ in. of tread.

Whether a tire is bald or still has tread makes little difference on dry pavement. Either way, the coefficient of friction is normally around 0.6 to 0.8.

On wet surfaces, it drops to 0.3 or less. At low speeds, up to eight miles per hour, the smooth tire actually grips better on wet pavement. But over eight miles per hour, a patterned tread holds better

than a smooth tire by an increasingly wider margin. At 30 mph, it has a 50 percent greater coefficient of friction. This is because a tread pattern wipes the pavement dry. On a rolling tire, the segments of the tread touching the road tend to move toward the center of contact. On dry pavement, friction prevents this movement. On wet pavement, water lubricates the rubber and allows movement. As the tread segments slip they wipe water into the spaces left by the grooves in the pattern and restore traction.

The more flexible a patterned tread, however, the faster it wears, and the deeper it is, the more flexible it is. Thus a 20-percent deeper tread may have only a 10-percent longer life. For the same reason, a tire wears fastest when it is new and the tread is deepest and most flexible.

Heat kills tires

In addition, the thicker the tread, the more heat it generates. Heat is the biggest killer of tires. Here is where we get back to the cheapie. It can't take heat. Since speed builds up heat, the cheapie isn't fit for the highway.

Speno wanted all replacement tires to be equal in quality to the original equipment. He wrote into his bill four lab tests for checking blow-out resistance and a requirement that the purchaser be told in writing what weight a tire could support without danger of blowing out. About 50 percent of present

The 78-year-old tire technology is improving steadily, mainly because of material. Construction has changed little; cord and rubber, a lot.

tires would be banned from New York roads.

More than 30 changes reduced the bill to a sickly remnant that easily succumbed to the final mercy killing. About all that was left were two tests for blow-out resistance devised by the U. S. National Bureau of Standards and used by the Federal Government for its own vehicles.

Speno passed the sorry remains to U. S. Representative Kenneth A. Roberts (D., Ala.), who as chairman of the House Health and Safety Subcommittee, will try to get the Speno provisions turned into Federal law.

With the admitted purpose of heading off legislation, the Rubber Manufacturers Association announced in July that it plans to subject new tires to three tests beginning Jan. 1, 1965.

A high speed test will check whether the tread can hold together at speeds up to 85 mph. An endurance test will run the tires 1,700 miles at 20 to 40 percent overloads. In a strength test, a steel plunger will be pushed into the tread until the tire breaks.

In spite of the impression given by the war on baldies and cheapies, good tires are getting better all the time. The 78-year-old tire technology is improving steadily, mainly because of materials. Construction

has changed little; cord and rubber have changed a lot.

Most cord today is rayon (Tyrex) or nylon. Nylon is stronger by weight than rayon. A nylon tire can take heat and impact better and usually costs a few more dollars than its rayon equivalent. Its drawback is that it forms a flat spot on standing and thumps for a short time after starting. New car dealers are afraid customers will blame their cars for the thump, so almost all original equipment tires are rayon. Replacement tires are 2:1 nylon.

2-Ply tires

A few years ago, the plastics companies who supply the cord came out with greatly improved rayon and nylon to make possible the switchover to 2-ply tires. The chief improvement in the cord was that it could last longer under constant flexing. Although the yarn in 2-ply tires is about twice as heavy as that in 4-ply tires, the sidewalls in a 2-ply tire flex more. This gives a softer ride. New car dealers liked them, because they hoped customers would credit the car. Tire companies liked them because their manufacture is more automated and cheaper. Lower manufacturing costs have kept the tire companies healthy in spite of price cutting.

To the car owner they give a

soft ride and cooler running at the risk of slightly greater vulnerability to sidewall bruising and punctures. Most 2-ply tires are labelled 4PR, meaning they are rated to carry the same load as a 4-ply tire.

Polyester tires

An even better cord material is polyester (Dacron, Vycron, Fortrel, Kodel, Terylene). It falls between rayon and nylon in strength, doesn't develop flat spots and surpasses both in heat resistance—and cost. It has been inching into the market as reinforcement in premiums.

Tire-makers have long yearned to use fiberglass. It is strong, non-flammable, chemically inert and holds its shape. But rubber wouldn't stick to it, and the filaments chafed each other. Esso Research and Engineering Co. and Owens-Corning Fiberglass Corp. have now licked these twin problems. They mix a chemical with the rubber which reacts with the surface of the glass fibers to produce a firm bond. The rubber coating, in turn, prevents chafing. The results have impressed the Air Force enough for it to order aircraft tires which are made with fiberglass cord.

Of the promising new kinds of rubber and rubber substitutes, one, polyurethane, would eliminate cord altogether. Goodyear has been showing off experimental colored, translucent polyurethane tires molded cheaply in one piece. So far, one-piece molding has been partly

by necessity, because polyurethane won't adhere to fabric cord. It is also costly and has several performance drawbacks.

Butyl rubber, a standard inner tube material, doesn't squeal when used on tires, and resists traces of cracking caused by chemical reaction with the ozone (O_3) in the air. It is great in resisting skids on warm, wet pavement, but is inferior on cold wet pavement, ice or snow.

Butadiene rubber prefers the opposite kind of climate. It wears poorly in the summer but well in the winter, which is why it has been blended only into snow tires.

Snow tires

Other improvements in snow tires have been aimed at increasing their traction by giving them a crepe-like surface. Goodyear has done this by mechanically punching holes in the tread. Recappers add sawdust or pieces of walnut shell to the rubber. When the chunks reach the surface, they wear out or drop out, leaving a pocket behind. A more sophisticated version of this scheme has been patented by a New York physician. He adds fast-wearing granules of specially formulated hard rubber.

Although snow tires give 70 percent more traction on packed snow, no one had been able to make them more than slightly better on ice, where chains were twice as good, until the Swedes began to put claws into their tires (an idea recently

Snow tires now come with claws which reduce stopping distance on ice 20 to 60 percent, increase starting traction 150 to 600 percent.

adopted in the U. S.). These are tungsten carbide spikes $\frac{5}{16}$ in. long driven into holes drilled in the rubber so that they stick up above the surface about $\frac{1}{32}$ in. They do, in fact, act like a cat's claws. On dry pavement, they are pushed up into a retracted position by the hard surface. On the relatively softer ice they dig in. Claims for the reduction in stopping distance on ice run from 20 to 60 percent; for the in-

crease in starting traction, 150 to 600 percent. But the cost for hand installation comes high. At 10 cents each for up to 200 studs, it's \$20 extra per tire.

Studs

In the current tire market, someone is sure to come out with studs one-tenth as good for only one-half as much.

Tip-sheet for tire-buyers

Unless you have x-ray eyes and the judgment of a tire engineer, there is no sure-fire set of rules. But here are some tips:

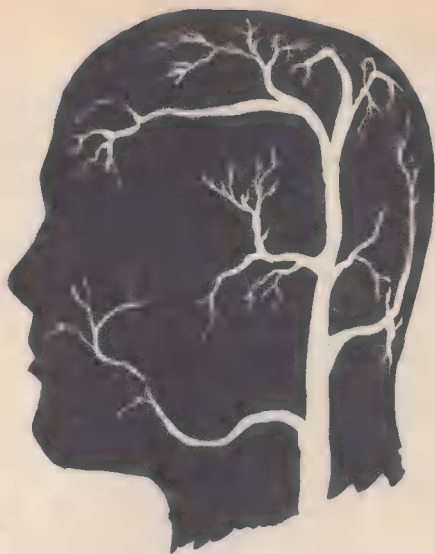
Get a definite statement of the grade in accepted terms such as first grade, third line, premium. Dealers may avoid ever mentioning the grade or they may substitute non-standard, purposely confusing terminology. In oddball brands, grades may mean little. Even in standard brands, grade gives only a rough approximation of quality.

Find out if the cord is rayon, nylon or polyester. If partly polyester, find out how much. (Of course, it is possible to make a nylon cord with the strength of a woman's stocking.) Is the construction 4-ply, or 2-ply marked "4PR" (for 4-ply rating)?

What is the price on which the guarantee is based—list or actual? Does the guarantee cover normal road hazards as well as defects?

Beginning Jan. 1, ask if the tire passed the Rubber Manufacturers Association's new tests. Pray these standards, or others to come, prove to be an objective rating system.

New attack on headaches



H EADACHE pain each year disables millions of persons so seriously that they have to seek medical help. But, though much progress has been made in the past 25 years toward understanding what causes headaches, they have yet to be conquered.

So staggering is the annual headache bill in lost wages, lost efficiency and human misery—not to mention the more than \$300-million a year Americans spend on headache pills—that the National Institute of Neurological Diseases & Blindness, in Bethesda, Md., has decided to do something about it. The institute has established a special advisory council of headache specialists to coordinate and expand research projects on headaches and to make sure that doctors know what's going on in the field.

Dr. Arnold P. Friedman, a member of the council and chief of the headache unit at New York's Montefiore Hospital says: "Substantial advances in our knowledge of the basic mechanisms of head pain have made possible a more orderly approach to diagnosis and treatment of patients with headache." Drugs, he points out, can perform miracles of relief for the two most common types of chronic headache—tension and migraine. But it is passing relief only.

Nine times out of ten, Dr. Friedman says, headaches are totally unrelated to any specific organic disease conditions. Most are tension headaches—a mild form of torture that almost everyone is familiar with. They are triggered, usually, by emotional tension or occupational situations in which the head or neck must be held in an awkward or fixed position for long periods of time, as in night driving in the rain.

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In a migraine headache, the patient involuntarily sets off reactions causing blood vessels to distend, thus exerting pressure on nerves.

It remains a mystery, though, why some people react to stress with their muscles (tension headache) while others get ulcers, skin trouble, and so on, and a favored few escape any such symptoms.

"There are no miracle or special drugs for relief of tension headache," says Dr. John R. Graham, director of the Headache Research Foundation, Faulkner Hospital, Boston. The backbone of treatment still is dealing with the patient's "sources of emotional tension."

Nor are drugs necessarily the predominant form of treatment for headaches. In some cases, the psychiatrist can help patients readjust to the stresses of living, though he, too, may prescribe a variety of chemical agents. Tension headaches, for example, are treated with muscle relaxants and tranquilizers; headaches associated with infections, by the use of antibiotics; with nasal disorders, by decongestants; and with migraine headache, by a drug called ergotamine tartrate.

In the migraine type of headache—a recurring nightmare for more than 10-million Americans—patients involuntarily set off reactions in certain arteries around the skull causing blood vessels to distend, exerting pressure on nerves. As the throbbing of the vessels continues, an unexplained action of certain body chemicals lowers the ability to

withstand pain. The result often is compared to "having a hot needle driven into my eye."

Although continued pressure on sensitive areas of the head by distended, pulsating blood vessels is painful, this alone can't account for the intensity of some people's suffering. Some understanding of the real cause of migraine pain may be on the way, however. This is the possible result of the discovery by a team of researchers, headed by the late Dr. Harold G. Wolff of New York Hospital-Cornell Medical Center, of a chemical called neurokinin which is found in the tissues around the swollen blood vessels of a patient undergoing a severe migraine attack.

Neurokinin is manufactured by everyone—the healthy as well as the headache-prone—whenever nerves are irritated. By making blood vessels expand and increasing the permeability of their walls, it causes more blood to flow to the affected area. In a person subject to migraines, however, the mechanism that makes neurokinin apparently works in response to emotional as well as physical irritation—and much more profusely than in nonmigraine patients.

Researchers point out that in addition to being a powerful blood vessel dilator, neurokinin also is chemically related to substances in

wasp venom and other venoms, and is capable of causing intense pain. So, the assumption is that too much neurokinin causes migraine pains, just as overproduction of the substances needed to digest food can produce stomach ulcers.

Migraines hereditary?

Other researchers raise the possibility that heredity may play a decisive role in the nature of migraine. Dr. Graham believes unequivocally that migraine headaches are the result of a "genetic deficiency." The disorder, he believes, manifests itself only when an outside stimulus—such as noise—requires an adjustment of circulation and metabolism in the head area which cannot be made because of genetic deficiency.

In the search for the cause of migraine, "it will be difficult at times not to confuse cause with effect, and to bear in mind that what we are looking for is probably an absence of something, rather than its presence," he says.

Perhaps the most vital point to understand is that certain emotional attitudes, and the personality traits that go with them, seem to make some people more headache-prone than others. The key to successful treatment, says Friedmann, is understanding these attitudes and then modifying them, on the principle that it is easier to change attitudes than jobs, mothers-in-law, or other life circumstances.

Prof. T. Dalsgaard-Nielsen, a

noted Danish authority on headaches, speaking at a recent symposium in New York, characterized most migraine patients as "sensitive, emotional, vulnerable, self-centered, perfectionist, enterprising, misunderstood and inclined to retain offenses." On the other hand, he stressed, research at the Frederiksberg Hospital in Copenhagen shows that migraine patients may be either overanxious or aggressive—but they are always inhibited.

Dr. Lawrence E. Hinkle, who is carrying on the research of the late Dr. Wolff, points out that migraine sufferers usually work at such fever pitch that they suffer sharp letdown when pressures are suddenly lifted. This may be one reason why severe headaches commonly develop on weekends and at start of vacations. Hinkle believes the explanation is physical as well as psychological—a biochemical "shifting of gears" as the body moves from full mobilization for stress to a period of relative calm.

Thus far, doctors have prescribed literally hundreds of agents, from tranquilizers to vitamins, in their search for a drug to stop migraines before they start. But, to date, they have had little success.

However, a relatively new drug called methysergide—a distant chemical cousin of ergotamine—seems to head off the painful dilation of blood vessels in migraine. The drug, taken two to four times daily, reduces the frequency and severity of attacks in two-thirds of all migraine patients at Montefiore.

The trouble with methysergide is that it is ineffective once a migraine headache has started, and occasionally may impair circulation. Nevertheless, Friedman calls it "by far the most effective of any agent of its kind" for migraine.

Researchers aren't sure exactly how methysergide works to prevent headache. One theory: The drug is a powerful antagonist of serotonin, a chemical found in the blood that causes dilation of blood vessels under certain conditions.

At 15¢ a pill, methysergide is a costly way out. However, a spokesman for Sandoz Pharmaceuticals, Hanover, N. J., which produces the drug, points out that patients with

severe and frequent migraine attacks often spend more than \$1. a day on less effective drugs.

In curbing the pain of migraine, once an attack has occurred, ergotamine tartrate often has been used quite effectively; it usually brings dramatic relief within an hour. Combining it with caffeine makes it even more effective, reducing the severity of migraine in 85 percent of patients.

Of the condition itself, though, Prof. Dalsgaard-Nielsen declares: "The mystery of migraine is not solved. It resembles the Chinese box puzzle—inside each box one succeeds in opening, another closed box is found."

"She's got the worst case of inferiority complex I've come across."



The Hugh Downs Column



NBC Photo

The two hats of science

ON BUSINESS in a strange city recently, I returned a borrowed car, thanking the owner but tipping him off that something was wrong with the brakes.

"Wrong?" he answered. "I just paid handsomely to have them checked and put in top condition. Did they fail you?"

"No, I just had to tromp on them pretty hard to get the car stopped."

"They are not power brakes, you know."

There it was. They were not power brakes. They really worked all right. I had gotten so used to mechanical assistance in braking today's heavy vehicles that a non-power brake was sufficiently strange

to make me accuse it of malfunctioning.

It set me to thinking. When power steering and brakes first came on the scene I pronounced them an abomination. I proudly purchased a car without them. I reasoned that a car was easy enough to drive unless you were an invalid or someone's aged spinster aunt and the evils of such use of power should be obvious: It represented (1) another contribution to the atrophy of human muscle tissue, (2) a factor to increase the danger of going to sleep at the wheel, (3) engineering skill expended in the direction of pampering an already over-pampered civilization, (4) vulnerability

We want escape from effort and reality—that's when we welcome the labor-saving devices. But we also have our life drive. That's the dilemma.

to failure of these complex mechanisms, (5) attrition of the human element in mechanicokinesthetic relationships.

And so on —

I rent cars now (it is much more sensible economically not to own and maintain my own car in the heart of a large city) so I no longer have my rugged no-nonsense, pamperless, non-automatic auto. And the ones I've been renting and driving recently have been furnished by the devil with every powerful, pampering, automatic, hedonistic frill that American automotive genius can devise to drug and entrap the weary in spirit and the vigorous hold-out alike.

Power steering and brakes were only the beginning in cars. Now you can also have power windows, power seat adjustment, power locks, power radio (yes, you don't have to exhaust yourself twisting that dial—the station seeker will go in search of and zero in on a sequence of signals), power antenna and radio remote-power garage doors.

I've soaked up so much automotive luxury that I fall into the pit of complaining about non-power brakes. How stealthily creep the deadly fumes of Sloth and Torpor. With what subtle comfort the enveloping Flab comes on.

What is this agency, I ask myself, that forces on humanity this

dangerous ease? A disquieting answer has come back to me from the mirror of my own vulnerability: The individual human is the agency. We want the power devices, not only to amplify our volition but to reduce our expenditure of effort, however small initially.

Once having tasted the joys of the electric fan, it becomes a nuisance to wave a cardboard fan in front of one's face. Once exposed to central air conditioning, turning on the electric fan is no longer satisfactory.

Nirvana

We want, it would seem, the tropical sea, the lush vegetation, the fruit falling off the trees. We want escape from effort and reality, we want diversion, we want sleep, we want oblivion.

But how then are we to explain the counter forces that have goaded man into exploring and conquering the farthest reaches of the earth?

Perhaps the solution to this seeming dilemma lies in recognizing the true difference in these forces. They do not tend to cancel each other out, because they are in different domains.

The life drive, eternal, mysterious, anti-entropic, transcending individuality, seeping through the Universe as water soaks into the

labyrinth of a sponge by capillary action, compelling, immortal, subtly powerful, belongs not to the individual, but to life.

On the other hand, the individual organism will tire and die, since man is a necessary victim of entropy; the second law of thermodynamics eventually overtakes the thrust given him at his conception and he will grow up and grow old and cease to function as surely as a stone thrown upward will rise, peak and descend to the ground.

Reproducing the spark

But in reproducing, the spark he passes on has all of the primal force inherent in his own launching, and perhaps more complexity.

It may be true, as some biologists have stated, that the individual organism is merely a vehicle, a host of the seed of life.

Assuming this stewardship, it is curious that the human animal has specialized in the direction of a developed intellect which reinforces self-consciousness and heightens the concept of individuality.

It is hard to speculate on these things without miring in the muddy channels of metaphysics. But it is fascinating to speculate on the true connection between the individual organism and the life drive of which he is a manifestation. The individual is more important than it seems he should be.

If he is merely a vehicle for perpetuating the Vital Force, why is the individual, unlike Life itself,

plagued with a frustrated desire for immortality? Why is the individual, unlike Life itself, doomed to certain death? Why does the individual, unlike Life itself, suffer from sloth? Why does the individual, unlike Life itself, gravitate to the dangerous ease of inactivity and the euphoric withdrawal from strife? Why, if Freud is right, do his only flashes of refusing death and defying fate stem from the sex drive, which is the urge the vital force gives him?

A man in love can perform miracles and rise to incredible heights of ingenuity and endurance, or in sublimating his sex drive, can bring prodigies out of his obsession. But this genius doesn't belong to him as an individual, it apparently only works through him.

Why on the other hand, does not the Life Drive appropriate intellect directly? It chooses to remain unlighted and to work indirectly through its mortal constituents, allowing them in their evolution to seek what ways they can of preserving their kind and finding some sort of happiness.

So my initial ascetic rejection of power steering and power brakes was (if we entertain the foregoing hypothesis) an evidence of the Life Force working through one of its individual organisms. And my complaint about the difficulty of operating non-power brakes, and the surrender to ease this represents, was the voice of my own mortality.

It may be an oversimplification to label all challenge "Life" and all

comfort "Death," but it does divide science into two sharp categories. The conquest of the Moon and Mars and the rest of space is an endeavor cut from the fabric of immortality, while the pop-up toaster and the electric nut cracker are proffered us by the bony hand of the Ferryman.

Panders to our sloth

Of course, not all our gadgets are subtle in their destructiveness: Science offers blatant shortcuts to death, such as nuclear weapons; and conversely there are scientific "comforts" not guilty of merely pandering to our sloth—pain killers and antibiotics and hospital tranquilizers are not in the same cate-

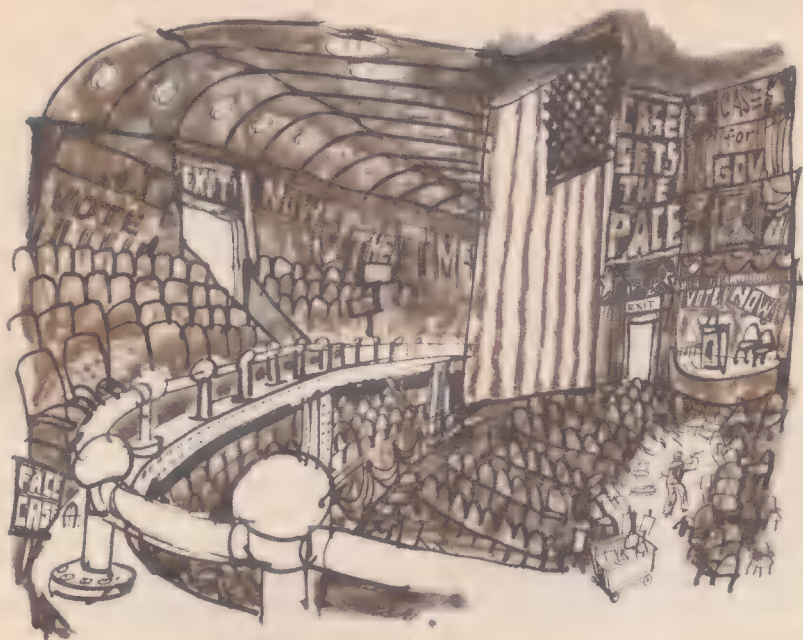
gory as the sleeping pill and appetite killer, or the soma pills of Aldous Huxley's *Brave New World*.

Meantime, because as individuals we are mortal and we are children, we will continue to call on science for the most unnecessary comforts and gadgets and diversions. And science will supply them because it is our servant. But we will hopefully also tax its genius to the utmost for ways to meet our challenges in space and in medicine because as Life we are immortal. And science is our servant here also.

Just forgive me if I dread the advent of the power zipper and the electric washcloth. They are bound to come and I'll fight them and then I'll be ashamed when I can't do without them.

"Do you think anyone will ever break the 4-minute yard?"





INSIDE PSYCHIATRY TODAY

The shock of political defeat

by Flora Rheta Schreiber
and Melvin Herman

BY THE TIME you read this, the elections have probably come and gone, leaving their residue of victors and vanquished among candidates and their supporters.

The shock of political defeat can be so intense that it results in murder. In the Tarascan district of Mexico, there is a village of fifteen hundred persons where over a thirty-five-year period seventy-seven persons have been killed, over one

hundred have been wounded and there have been hundreds of armed skirmishes over political issues. The bond of identity with a candidate is so strong among voters, through ties of religion, class and political philosophy, that an act of violent retaliation to political defeat is considered an act of loyalty and self-defense. A political rival is seen as a man who betrayed both their and their candidate's principles.

A United States counterpart of this feeling of betrayal occurred during the administration of the late

Politicians often have built-in personality defenses as well as remunerative law practices to fall back on after an election defeat.

President Franklin D. Roosevelt. "That man in the White House" was a term of derision and hatred directed at him by persons who identified themselves with wealth and family background and who felt that he had betrayed his class and the principles and convictions that accompanied wealth and social position.

With every defeat, psychiatrists tell us, there is apt to be almost inevitable feelings of guilt. "I was punished because I am not good enough," runs the inner monologue of self-recrimination. "This is the way life must be for me; I deserve no better." The truth is, however, that no one is punished for his sins in politics, except for his sins of omission. The candidate who made a halfhearted campaign effort (hardly true of the presidential candidates in the campaign just waged) actually may have feared success. He also may have been punishing himself by seeking a self-inflicted failure.

As partisans, we are in many ways like a nation of "Met" baseball fans—the fantastic "new breed"

who enjoy dying six or seven times weekly following their underdog heroes whose near wins seem to give more satisfaction than their victories. Each day brings a bitter-sweet revival of hope.

There is a strong magnetic pull to failure and especially to heroic failure. The candidate who can say, "I didn't win because I'm ahead of my time," or "I was misrepresented by the press," has a victory that may be very satisfying to himself.

Knowing how to fail is an art. Dr. Erick Erickson, of the Austen Riggs Center, speaks of a patient who remarked, "That people don't know how to succeed, is bad enough, but it is even worse that they don't know how to fail. I've decided to fail well."

The politically unchosen can take their text from Matthew XX; 16 "... for many be called, but few chosen." And indeed they do, rallying after defeat to seek office again, often the same office, or sublimating their political hopes temporarily in appointed government positions. Among the principals in this campaign, all knew defeat four years ago. Barry Goldwater was placed in nomination as a Presidential candidate but was rejected for both the Presidency and Vice-Presidency. Also in 1960, both Lyndon Johnson and Hubert Humphrey made vigorous bids for the Presidential nomi-

Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

nation and were soundly defeated. William E. Miller, even before accepting the Vice-Presidential candidacy, made plans to return to his law practice, if defeated in his bid for re-election to Congress. His five-year-old son, Billy, had asked fearfully, "What happens if Daddy loses?" His father told him, "Nothing happens. We will move to a nice new house and go on as before." Didn't Adlai Stevenson, twice defeated for the Presidency, move to the U.N. and, with the ready wit and articulateness that had been an obstacle in the presidential campaign, become a respected national spokesman?

Of course, the appearance of acceptance of defeat is not the same as inner acceptance. Carmine de Sapio, the ousted leader of Tammany, reportedly handed over his seat of honor on the National Democratic Committee with a handshake and a smile and, as his ex-colleagues said, "as a gentleman." But also, if the newspaper accounts are true, this tough and battle-tried political warrior had tears in his eyes.

Politics is a gamble and appeals to gamblers. Politicians often have built-in personality defenses as well as remunerative law practices to fall back on. But failure is a test of character. It is a strong man and often a happy one who, stooped in defeat, stands erect again to rebuild his pulverized political career or a local political machine.

Often it is not the defeated candidate but his henchmen and his

devotees among the public as a whole who are most inconsolable. "There is an instinctual need to identify," says Mortimer Ostrow, M.D. "This means that although we feel elated at the success of political figures, we also suffer from their defeats." One of the authors was in Richard Nixon's Senate office when his staff was packing. From outside came the sound of marching feet—the palpable presence of rehearsal for the Kennedy-Johnson inauguration of 1961. A secretary turned from the offending window, with tears in her eyes, and cried, "Shut up!"

Much of the anguish comes from over-identification with the candidate. People have a way of submerging their own identities with that of their party. A candidate can give his followers a big life on which to hang their lesser ones. Party defeat to such persons is shattering.

It is the more shattering perhaps because it represents the collapse of not only an illusion, but also a delusion. Studies show that during an entire campaign members of a political group are apt not once to discuss politics with a member of the opposition party. They forget that there is any point of view other than the one they espouse. The result is that, when defeat comes, their imaginary world collapses. They are caught in what Dr. Eric Fromm calls a "folie de millions"—analogous to a shared disturbance between two which is known as a "folie de deux," for even a great

A schizophrenic child invented a time machine that permitted him to travel back into history to change the course of world events.

party with millions of members can infect itself with delusion.

To lose is part of the battle. As long as there is free political choice, there is anxiety. Paul Tillich described the political situation in Europe in the 1930's, out of which German fascism developed, as "a time when there was so much anxiety that political security seemed to be lost and people felt that freedom that leads to fear and anxiety has lost its value; that it is better to have authority with security than freedom with fear!"

Anxiety can thus become a threat to freedom itself. Just as individuals seemingly healthy become neurotic and psychotic, so can an essentially sound society become a sick one. Dr. Rollo May, a leading authority on existentialist psychiatry, commenting on the Tillich statement, has said, "Totalitarianism in this sense may be viewed . . . as parallel to the situation in which a neurotic symptom protects an individual from a situation of unbearable anxiety."

Only by a complete surrender of political freedom can we be protected from a chance of political defeat. Winners and losers alike in this year's election will agree that the price is one they cannot afford. If we are to have free elections, we must have good winners and good losers.

The space-child ten years later

When Tom was eleven years old, he was a prisoner of his inner world, unable to get out to know the outer-world. He tried to master his problem by creating an emotional distance between himself and the world. He became a space-child. His world was filled with bizarre fantasies, all of which fell into the pattern of "distance through space."

He saw himself, as a "five-star general" and was able to maintain a distance from everyone around him by assigning titles of lower military rank to them. He talked in terms of hundreds and thousands of light years. He had erected an elaborate structure of defense through distance.

He had invented a Time Machine that permitted him to travel back into history to change events. He could travel back and kill a German Emperor who would influence the trend to world war before the Emperor had a chance to be influential. "Of course," Tommy told his therapist, "this will screw up history and all the history books."

The Time Machine helped Tommy deny his helplessness, his loneliness, his fear of dying or killing someone.

He also invented a planetary fantasy in which the world was the

youngest of all the planets, finding it difficult to adjust to the planetary system. He involved himself in inter-planetary military clashes.

His case attracted wide attention. Interest in his treatment brought together a diverse group of professionals at the Menninger Foundation. They focused efforts on understanding the ego psychology in schizophrenic-like children.

At first the therapist—according to a report given by Dorothy G. Wright, child therapist, and Rudolph Eckstein—used the conventional therapeutic methods. But they failed. Tommy became more and more withdrawn in his fantasy space world. It became necessary for the therapist to accept the main modes of defense and adaption Tom used, as well as his peculiar space language, and enter his fantasy world. This was a type of relationship acceptable to Tom.

Slowly Tom seemed to accept a lessening in distance between himself and the therapist.

Today, Tom is 23 years old. A college teacher, he is doing graduate work in preparation for a career (hold your breath) in space research. He is married and has twice travelled through Europe in conventional vehicles.

Tom changed from a child victim, creating a separation from the world, in desperation using his bizarre imagination to do so, to a man who could use separation from childhood as a matter of free choice and a step toward maturity and productive functioning.

The need for silence

From an interview with Dominick Barbera, M.D., prominent New York psychoanalyst and author of *The Art of Listening*:

"The urge to talk for talk's sake is a compulsion with which all of us are familiar.

"The compulsive urge to make a statement on any subject, whether it be foreign to us or has been experienced, is a major source of the superficiality and emptiness of much of our verbal communication today. We are too ready to take and accept passively what we hear from others and to regard what we accept as truth without first giving it full expression and experience within ourselves.

"Productive or reflective silence is a quality that all of us should encourage and develop within ourselves. However, there are situations where silence makes for disturbed interpersonal relationships. The everyday necessity for working with others, the perpetual contacts with strangers and the accentuation of group life has made verbal communication essential. To maintain silence in the presence of others may well lead to tension and unfriendly regard, since an unwillingness to talk is often interpreted as an attitude of unfriendliness.

"In our society we find those who, because of inner conflicts and anxieties, are unable to present sufficient purpose or the feeling of aliveness to their way of life. They

are pervaded with a paucity of inner experiences restricted both to their emotional life—their consciousness of pain, joy, hope, disappointment—and to those areas that include thinking, willing, wishing, believing, doing. As Karen Horney has explained it, it is as if a person had 'turned his back on his inner life; as if it was all covered by fog; as if he had closed an airtight or soundproof door; as if he had walled off everything. It may be a glass wall through which he still can observe what is going on without experiencing it. The fog is usually not equally thick; it may lift at times and at others become impenetrable. Then feelings of unreality may result. All of a sudden some hurt, some loss, some work of art may penetrate and elicit a response.

"One important reason why many of us today live in a superficial manner, I feel, is the fear of becoming silent with ourselves and listening to the truth of the matter.

"By becoming silent and looking actively within ourselves and by seeking constructively for the truth about ourselves and the world we live in, we shall arrive at a realistic, dynamic and complete awareness of *what is* and so shall come into a truthful and healthy pattern of existence.

"In the struggle toward self-realization, many of us at times either refuse or do not know how to be silent or how to listen effectively. In seeking to understand the communication of one's own conscience, one may be able to listen to one's self. So many of us listen by intention—i.e., listen to other voices, opinions, rationalizations — rather than to our own.

"In some, the fear of being alone and silent is so intense that they prefer the most meaningless activities—living on the periphery of their personalities, or engaging in some activity or being with someone they dislike intensely—to being alone with themselves."



Pep pills blur judgment

EVIDENCE that amphetamines (goof balls or pep pills) significantly impair judgment was announced by Dr. Gene M. Smith, a Harvard Medical School scientist. He conducted investigations in which judgment was studied by comparing a subject's actual performance on a 60-minute calculus test with his perception of that performance. Each subject in the research project was given amphetamine sulfate before two tests, secobarbital sodium (a sedative) before one test and a placebo (an inactive substance) before two tests. To determine the subject's judgment-error score, the number of problems solved correctly were subtracted from the number the subject estimated he had solved correctly. After the placebo, the subjects overestimated to a significant degree the number of problems solved correctly. After the amphetamines or secobarbital, the overestimation tendency, or judgment-error, was greater still.



Actress Shirley MacLaine and daughter Stephanie are striking genetic look-alikes. Photograph was taken on the set of 20th Century-Fox picture, "What a Way to Go!"

A hereditary quiz

by John and Molly Daugherty

THE CELL is the basic unit of life. Each human cell contains a complete set of hereditary determiners which are originally found in the fertilized egg.

Normally, human cells contain 46 chromosomes. In the chromosomes, thousands of genes convey the hereditary characteristics. The genes carry information that the cell machinery follows through biochemical means.

How much do you know about these basic biological processes?

1. The sex of every child is determined by
 - a. The father alone
 - b. The mother alone
 - c. Both father and mother
2. Hereditary baldness is common among men. Which is true about the baldness gene in males?
 - a. It is a recessive gene because not all men are bald.
 - b. If you have two baldness genes, all of your sons will become bald.
 - c. If you have only one baldness gene, you won't become bald.
3. What chemical substance in the nucleus of cells is now considered to be or to provide the physical basis of heredity?
 - a. Protein
 - b. DNA (deoxyribo-nucleic acid)
 - c. RNA (ribo-nucleic acid)

4. If a pure-white guinea pig is bred to a pure-black male, the off-spring are
 - a. All black like the male
 - b. All white like the female
 - c. Half black and half white
5. Which general chemical substances are the chromosomes largely made of?
 - a. Fat
 - b. Carbohydrate
 - c. Protein
6. If you carry the recessive gene for inherited feeble-mindedness, congenital deafness or blindness, albinism, or diabetes, but your mate does not carry the same gene, your children
 - a. Will be afflicted
 - b. May be afflicted
 - c. Will not be afflicted
7. Protein molecules are giant molecules of great complexity built from amino acids. How many different amino acids are found in almost every protein?
 - a. 21
 - b. 32
 - c. 39
8. Your chances for living to be ninety are best if you
 - a. Have a long-lived parent and two or more long-lived grandparents
 - b. Are an unskilled laborer
 - c. Are an unmarried man
9. Among various peoples, hereditary color-blindness varies considerably. Which of the following displays the lowest percentage of color-blindness?
 - a. White Americans and Europeans
 - b. American Indians
 - c. Eskimos
10. The frequency of changes that occur in hereditary material is very low. These changes are called gene mutations. Many of them are recessive rather than dominant. Which of these statements is not true?
 - a. About 30 percent of us carry one newly mutated gene.
 - b. Most of us carry no mutated genes unless exposed to various radiations.
 - c. All of us carry mutant genes, mostly of the recessive type.

Answers:

1 - a The father alone. Half of the sperm cells of the male contain X chromosomes and the other half, Y chromosomes. The female egg cells contain X chromosomes but no Y ones. If one of the sperm cells containing a Y fertilizes an egg cell, the resulting combination is XY, creating a boy. If a sperm containing X causes fertilization, the result is XX, creating a girl.

2 - b Two baldness genes in the father means that all his sons will become bald. If the mother carries two also, the daughters will develop baldness. However, the trait in women is recessive, and the baldness produced is only partial. Baldness is dominant in the male. Even if only one gene is present, one son in two will become bald.

3 - b DNA is a giant molecule formed of two thread-like chains coiled around each other. This chain has been shown to be a double helix shaped like a circular staircase. DNA must store the information from which proteins are built and transmit it beyond the nucleus to the machinery of the rest of the cell. DNA replicates itself in cell division to create new cells. Apparently RNA carries the message of the genetic code from the DNA of the chromosome into the cytoplasm of the cell, where the new protein is formed.

4 - a All black. Each parent carries a pair of genes, ww for the white guinea pig and WW for the black. When the egg is fertilized, one w from the female and one W from the male will be present in the egg, wW. Each offspring contains this pair

wW, but W (the symbol for the black coat) is dominant in guinea pigs, so all offspring are black. But the offspring all carry a recessive white gene now which affects the next generation.

5 - c Largely protein. The most important substance in the chromosome is protein. (*Protein* is from the Greek and means "of first importance.") A cell of hemoglobin of blood is protein in part and non-protein in part. From the nuclei of cells, nucleic acid has been isolated. It is joined to the protein of chromosomes and is called nucleoprotein.

6 - c Your children will not be afflicted. When a child has a recessive defect such as these, he has inherited it from both parents. One parent cannot say to the other, "It comes from your side of the family." Each parent has to carry the same recessive genes for the child to be afflicted.

7 - a Another can be added, making 22, but it is found principally in only one protein, a very important one—collagen. It is the only protein containing the amino acid hydroxyproline. Collagen makes up a large share of the connective tissues of your body. It is found in tendons, cartilage, ligaments and other parts of the body.

The number of different proteins that can be built out of 22 different amino acids is practically unlimited.

8 - a If you have a long-lived parent and several long-lived grandparents. Seven out of eight oldsters of ninety or more had such an inheritance. Although heredity determines your longevity within potential limits, many other factors affect how long you will live: luck, sex, social and economic conditions, occupation, etc.

Unskilled laborers have the shortest lives of any occupational group; professional men, the longest. Married men live longer than single ones. More married women than single ones die under forty, but after forty, women don't have to stay single to live longer.

9 - c Eskimos. Among Eskimos, fewer than 1 percent are colorblind. Color-blindness in white Americans and Europeans runs about 8 percent, in Negroes, 4 percent. The incidence in American Indians is 2 percent.

Color-blindness chiefly affects the male, and it comes from a color-blindness gene of an X chromosome transmitted from mother to son. There are at least eight times as many color-blind men as there are color-blind women.

10 - b This is false. But mutant genes, if recessive, may be passed through many generations — even hundreds — without detection until a carrier of one by chance marries a carrier of the same gene. The non-mutated one of a pair of genes gives us considerable protection by covering up our load of bad recessive genes. From the occurrence of new dominant genes the frequency of occurrence of recessive mutated genes can be estimated. An estimated 30 percent of us carry one newly mutated hereditary gene.

Score Yourself:

9 - 10 right—Gene-ius.

4 - 8 right—You inherited a good enough score.

1 - 3 right—Don't worry. Gregor Mendel, the father of genetics, couldn't pass a teacher's examination.

THE LATE SCIENCE NEWS

A scientific controversy is now raging in the medical literature and on Wall Street. It will soon reach the average American's dinner table. The questions: Are artificial sweeteners (saccharin, etc.) dangerous and do they really help keep weight down?

A group of 25 prominent doctors suggested that medical researchers take another hard look at the safety of sweeteners. Sweeteners had been considered safe for years, but that was when their use was limited. Today with the low-calorie business booming (Americans will gulp 5 million bottles of "diet" soft drinks this year), the doctors feel new tests are necessary. Royal Crown (the company that controls 35 percent of the low-calorie drink market) stocks, which had been rising, fell to a low for the year. Abbott Laboratories, a leading producer of sweeteners, fought back, but the 25 doctors stood firm.

Meanwhile, sugar producers, stung by increasing use of artificial sweeteners, began an ad campaign saying the synthetics really didn't help lose weight. "Drinking them is like trying to lighten an airplane by emptying the ash trays." Royal Crown countered with, "Have you tried the taste that made the sugar daddies mad.?" The doctors seemed to back the sugar industry by saying sweeteners are of "questionable value" in reducing.

With so many hands in the sugar bowl, the whole thing will probably be dumped in the lap of the FDA. One conclusion: The general public must have a better understanding of science to be able to evaluate the claims and counter-claims of those who have a vested interest in one side or the other of a scientific controversy. Neither FDA nor other organizations can really protect the public interest--the only group that can do that is an enlightened public itself.

Tartar, that old villain of the tooth decay story, may not be so bad after all. So says Dr. Albert Sobel, whose discoveries may lead to a method of stopping tartar build-up. "Perhaps normal amounts are nature's repair mechanism on the surface of teeth which are continually worn away or dissolve in trace amounts." We better find out why it's there before we rush to get rid of it, he says.

There was both good and bad news for astronauts. Good: Space biologists now feel that radiation is no immediate danger to astronauts. They should be able to get along without extra shielding. Bad: Previous manned flights and recent animal tests show that prolonged weightlessness seriously affects the inner ear and may cause more disorientation than previously estimated (see Science Digest, Sept. '64). Nerve cells in the inner ear directly affect muscular control and control of nerves in the stomach. Inner ear disruption could explain the nausea suffered by U.S. and U.S.S.R. astronauts.

New and surprising findings about the planets were announced at the General Assembly of the International Astronomical Union in Germany. Venus is slowly spinning backward, in the opposite direction of every other planet in the solar system. . . Mars has a sheet-like wind pattern, very different from the turbulent motion in the earth's atmosphere. . . Mars may also have an extremely intense radiation belt. . . The dark side of Mercury, commonly thought to be utterly cold, may be about room temperature. . . Saturn, thought to be frigid, may also be temperate.

NASA plans to launch two Marinerspacecraft on 8-month missions to Mars before the year's end. The probes, however, will not contain an instrument to detect oxygen, hydrogen and water vapor in the Martian atmosphere, which could have given a clue to the existence of life on Mars. Technical problems caused the instrument to be dropped. . . The White House is carefully considering a more complex Mars probe for 1966 (see Science Digest, Oct. '64). Technical and budget considerations will probably delay the launch until 1971 or 1973.

The Nimbus weather satellite is working beautifully despite a hitch in the launching which put it into an elliptical instead of a circular orbit, (see inside back cover). Nimbus is sending back the first night-time pictures of the earth's cloud cover. Pictures are taken by infrared photography and were clear enough to show such landmarks as the Volga river and major mountain ranges.

Communications between Vietnam and the U.S. will be beamed via Syncom II and the recently launched Syncom III. Messages will move faster and help U.S. officials keep up with the unstable, ever-changing picture in Saigon.

New space worry: Satellite "junk" orbiting the earth may threaten new launchings. More than 800 pieces -- dead satellites, rocket casings and explosion fragments -- are now circling the earth. The problem grows daily.

President Johnson's announcement of radar that can "see" beyond the horizon represents fulfillment of a dream electronics engineers have had since World War II. In theory the key was simple, use waves long enough to be reflected back from the ionosphere, like radio waves, but short enough to be directional. Practical application of this theory took years of intensive experimentation.

Two of the biggest jobs in the world were begun recently. AT&T started converting the nation's telephone network to all-electronic switching. The changeover will cost \$12 billion and take 35 years, but will allow each user to tailor his telephone service to his own needs. First regular all-electronic exchange will be the Pennsylvania-6 exchange in New York City. . . Rock-borings were started in the English Channel to determine which of two building methods would be best for the proposed \$500 million tunnel (see Science Digest, Jan. '64). Construction dates have not been set.

Time has changed. Scientists from around the world have agreed to use the vibration rate of the cesium atom as the basis on which units of time are calculated. Previous base was the length of the year 1900. The change won't affect your kitchen clock but it will be of great importance in the laboratory.

A Franco-American team on the bathyscaph Archimede found a remarkable feature in the deepest part of the Atlantic Ocean. On the north and south walls of the 27,500-foot-deep Puerto Rico Trench they saw terracing which resembled a fantastic stairway with steps a hundred miles long, more than a hundred feet wide and about ten feet high. They were also surprised by the abundance of life at depths where the pressure is 12,000 pounds per square inch. . . One form of sea life, however, may be facing extinction. British fisheries expert John Gulland says that virtually unrestricted whaling has brought this ancient and romantic industry to the verge of collapse. At this stage of decline, he says that only the intervention of an international body can save the whales.

QUOTE OF THE MONTH: "The popular belief that Lee Oswald was involved in a plot is not taken as an indication of widespread paranoia, but as a normal response to a bizarre and threatening situation." Drs. Paul B. Sheatsley and Norman M. Bradburn commenting on their study of the American public's response to its grief over the assassination of President John F. Kennedy.

Portrait of two continents

WHEN looking at a map, an ordinary man, unschooled in the complexities of map-making, may sometimes wonder, "How do they *really* know it looks like that?"

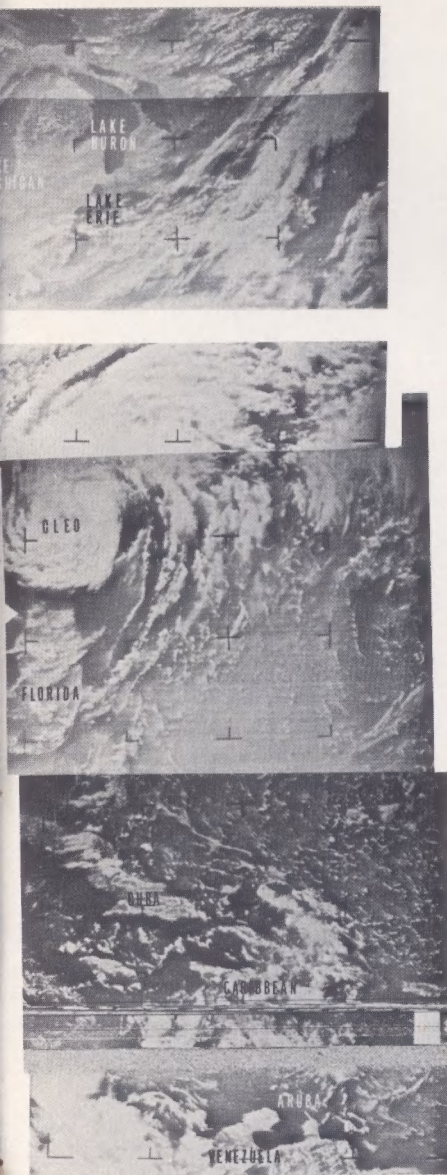
Man's faith is often shaken. Aside from the Big Dipper, none of the constellations even faintly resemble what they are named after, and any first-year biology student will tell you that a cell under a microscope doesn't look anything like the diagram in the lab book.

Now satellite photography has removed once and for all at least the map-reader's nagging seed of doubt. (As it has also answered that highly unscientific, but persistent question, "How do we know the earth is *really* round? It *looks* flat.")

In this remarkable series of photos taken by the advanced weather satellite Nimbus I, the outlines of the Great Lakes, Florida, Cuba and the coast of Venezuela look just like they do in a good atlas.

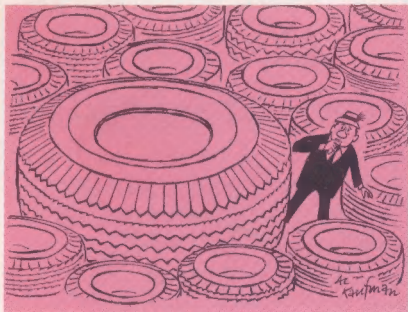
Equally satisfying is the appearance of hurricane Cleo, then centered in northern Florida. The spiral sweep of clouds about the storm's center is almost an exact duplicate of a textbook diagram.

Such close correlation between diagram and reality may restore the ordinary man's faith in all charts and diagrams.



These photos were taken from Nimbus I from an altitude of about 500 miles. Distance between cross marks is 220 miles.

Also in this issue . . .



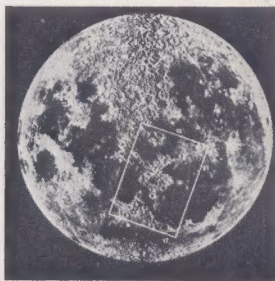
Lost in a tire jungle? Science Digest's special report will help you evaluate new tire claims, names and prices. The story begins on page 69.



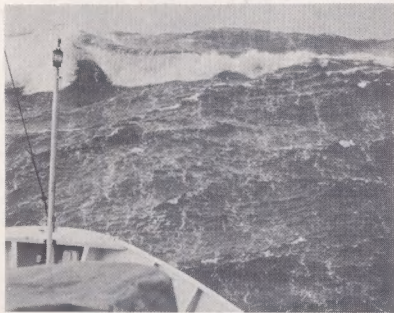
No two persons could better illustrate the principles of heredity than actress Shirley MacLaine and daughter Stephanie. See pages 89-91.



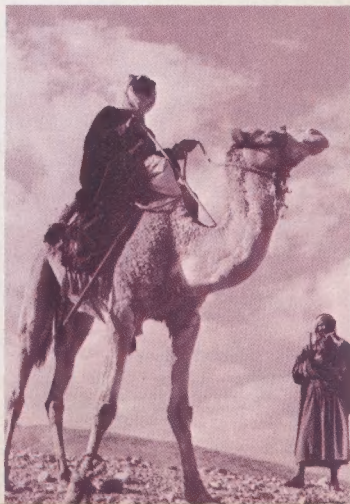
This tiny bird, trapped in a net, can be a deadly killer. It is a host for disease-carrying ticks. In India, where many hold all forms of life sacred, scientists have developed a unique method of dealing with the problem of this bird-borne plague. Page 64.



Today the moon sets us dreaming about things other than romance. Some are even dreaming of it as a possible vacation spot. A way to plan your "holiday on the moon" is outlined on pages 34-35.



For years, sailor's tales of 100-foot waves were classed as "fish stories." Today science is discovering such monsters may be common. Page 59.



The camel does not store water in his hump. To find out where he does store it, see story on page 25.